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Nr. 7. Bjarni Sæmundsson: ON THE AGE AND GROWTH OF THE COALFISH (GADUS VIRENS L.), THE NORWAY POUT (GADUS ESMARKI NILSSON) AND THE POUTASSOU (GADUS POUTASSOU RISSO) IN ICELANDIC WATERS

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI
1929

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BY

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Introduction.

In the years 1923 and 1925 I have, in the present Series of Meddelelser fra Kommissionen for Havundersøgelser, issued two papers dealing with the age and the growth of some of the species of the genus *Gadus*, viz. the two most important of them, the Cod[1] and the Haddock[2], and the Whiting, chiefly based upon investigations made by the present writer; when collecting material for age-determination I often have taken the opportunity to collect material from the other species of this genus, especially from the Coalfish and the Norway Pout, where they were at hand, as already mentioned in my paper to 1925. Yet the greater part of this material has been provided in the later years onboard a commercial trawler.

Besides the five species of *Gadus* mentioned, which all are very common in the waters round Iceland, two more species are known there, of which the one, the Polar Cod (*G. saida* Lap.) is pretty rare, the other, the Poutassou (*G. Poutassou* Risso) very numerous off the S.- and SW.-Coast, but only as young and immature fish[3]. Of the first named I have got no material at all, of the last-named only a small number, but sufficient for determining the prevalent age of the fish when found at Iceland.

On the following pages I am going to treat the two above-mentioned fishes, the Coalfish and the Norway Pout[4] more thoroughly and the third one, the Poutassou only very briefly, leaving the Polar Cod quite out of question. The first-named of these three, the Coalfish is very abundant and of a considerable economic value, being caught in great quantities by natives and foreigners, the second one, the Norway Pout is also very abundant, possibly (as Schmidt remarks) the most numerous of all Icelandic species of *Gadus* but of no direct economic importance; the third species is far behind the other two in number and of no direct value.

I. The Coalfish (Gadus virens L.).

The Coalfish (Icelandic: ufsi) is very common all round the country and extremely numerous in the warmer waters on the S.- and W.-coasts, where it can be met with on all depths down to 200 m. The waters off these coasts can be regarded as its proper home, where it has its spawning area common with the Haddock[5], but spawns considerably earlier, viz. already in mid-February. When spawning is over, the mature fish roam, in search of food, round about on the banks off the S.- and W.-coasts, or move quite into the colder water on the N. and E.-coasts.

[1] Meddelelser fra Kommissionen for Havundersøgelser, Serie Fiskeri, Bd. VII. Nr. 3. København 1923.

[2] Ibidem, Serie Fiskeri, Bd. VIII. Nr. 1. København 1925.

[3] Cfr. the Author: Synopsis of the Fishes of Iceland, Rit Visindafjelags Íslendinga II. Reykjavik 1927.

[4] A preliminary account of these investigations is given by the author in his biennial Rapports to the Government (Fiskiraunsóknir 1923—24 and 1925—26).

[5] Schmidt, Johs.: The distribution of the pelagic fry and the spawning regions of the Gadoids in the North Atlantic from Iceland to Spain. Rapp. et Proc.-Verbaux du Cons. internat. pour l'exploration de la mer; Vol. X, p. 34, chart II. Copenhagen 1909.

In a similar manner the pelagic fry spread, carried along by the currents, and seek into quite shallow water in the bays and firths all round the country and will stay there the 2—3 first years of their life, but after that they begin to seek the open sea and join the grown-up fish. — Although being a pretty big fish (the mean weight of the grown-up fish is abt. 7.5 kg.) and caught in considerable quantities, especially in trawl and codnets, the Coalfish is of a rather little commercial value in proportion to the quantity, as its flesh is not much liked and the price usually very low.

Fig. 1 A. Scale of *Gadus virens*.
II-gr., Alftafjord, 29.-VII.-1915.

Fig. 1 B. Scale of *Gadus virens*.
V-gr., Hali 1.-12.-IX.-1925.

As far as I know, very little has hitherto been published about the age and the growth of the Coalfish, although it is a fish of no little importance to countries on both sides of the North-Atlantic. Save for the Norwegians who have studied the growth and the migrations of the fish and published the results in papers by Dr. DAMAS[1] and Mag. O. SUND[2] and others, nothing is known to me as having been done by other nations.

1. Age and growth determinations.

a. Collection of material.

As Coalfish of the 2—3 first year-groups (0-, I-, II- and even III-group) are extremely numerous in every inlet and creek on the South side of the Faxa bay all the year round, and an object of seine-

[1] Contribution à la biologie des gadides, Rapp. et Proc. Verbaux du Cons. intern. pour l'exploration de la mer. Vol. X., p. 167. Copenhague 1909.

[2] Mærkning av sei i Nordland Sommeren 1921. Report on Norwegian Fishery and Marine Investigations. Vol. III. No. 5 Bergen 1925.

fishing in some places there, as Keflavik and Hafnarfjord (in the eighties and nineties of the last century, also in the Capital), I have had rich opportunity to examine such catches and measure lots of fish in my first years of investigations. Later on, in the years 1903—05, when the international research-work began, under the leadership of Professor JOHS. SCHMIDT, I had as a participant in the investigations

Fig. 1 C. Scale of *Gadus virens*. XI-gr. Vestman Isles 15.-VIII.-1919.

onboard the research-vessel, the "Thor" a good leisure to survey catches of young Coalfish made in Hafnarfjord, Siglufjord and Seydisfjord, or from the records in the research-journals make me acquainted with the results of the capture of the fish in other localities, when I was not present. — In the summer of 1908 and 1909, on motorboat-trips to the firths of the NW.-peninsula and in the great bays, the Breidafjord and the Faxa Bay, with their numerous, often very shallow inlets, I examined great numbers (abt. 16000) of young Coalfish caught by eel-seine.[1]

[1] Fiskirannsóknir 1908—1909, Andvari.

In the summer of 1915 I visited the NW.-peninsula and collected material in two places: Vatneyri (Patreksfjord) and Isafjord.[1] In the first-named place I caught 170 specimens (4—11 cm., 0-group) by eel-seine and in the latter 60 on handline.

In the years 1924—1927 the "Dana" has continued the investigations formerly carried out onboard the "Thor", in different firths on the W.-, N.- and E.-coasts. In all these years I partook in these investigations, in 1924 and 1926 for a long time, and had a rich opportunity to survey a great number of young Coalfish in different places in Faxabay, Patreksfjord, Isafjord, Skagafjord (Hofsós), Eyjafjord and Nordfjord or see the results of captures made in Seydisfjord and at the Westman Isles in the research-journals.

All the material thus provided was confined to the 2—3 first year-groups of the fish and for the greatest part to measuring of great numbers of individuals in each place; in comparatively few cases only I could manage to collect scale-samples, nor are the scales quite necessary either for reliable determination of the age as far as the three first year-groups are concerned *(vide infra)*. I got scales from nearly 600 specimens caught in Faxabay, Isafjord Deep, Siglufjord and Nordfjord.

For collecting of the material needed for age-determination of older fish, which as a rule roam about in offshore waters, it was necessary for me to cooperate with our fishermen, who capture great lots of that sort of Coalfish. For that purpose I collected scales from 14 specimens of Westman Isles in August 1919 and went to the NW.-firths in the summer 1923, where I succeeded in getting material from 106 medium-sized and large fish, caught on long lines by Bolungavik-fishermen off Isafjord Deep. But now it can turn out to be pretty difficult to get the material needed from open boats only, as the medium-sized fish wants not to take the bait on the lim-hooks and manage to escape through the cod-nets. On the other side the trawlers take the medium-sized and large Coalfish equally, all the year round, on the offshore banks, so that there is a very good opportunity to get the necessary material in that way. For that reason I have made five trips to different parts of the coasts in the last four years, onboard the trawler "Skallagrimur" of Reykjavik, owned by the firm "Kveldúlfur" and commanded by Mr. Gudmundur Jonsson. In two of these trips I collected material (scales) from 106 fishes caught off the SE.-coast (Eystra-Horn) 1925 and from 260 fishes caught off the NW.-coast (Hali) 1926. But as material from the SW.-coast was highly needed, I applied to the wireless operator of the "Skallagrimur", Mr. Einar Benediktsson, who was good enough to collect scale-samples from 100 specimens captured on Selvog's Bank 1927, to which samples I myself added scales from 18 specimens onboard the "Skallagrimur" from the same place April 19th 1928. Finally I took scales from 24 specimens on Dritvikurgrunn off Snæfellsnes onboard the same trawler May 7th 1927.

From the above recorded it will be seen, that I have collected or surveyed vast material for age-determination of young Coalfish all round the country, although a rather poor one from the S.-coast. As to other material I have only been able to get it from the SE.-, S.-, SW.- and NW.-coasts, from alltogether 628 specimens, but none from the N.- and E.-coasts. Though this will, I suppose, make no great difference, as the grown-up fish, which is to be found in those waters, surely are summer-visitors, which seek thither in search of food, and retire to the warmer waters during the cold season. If these same individuals actually have spent their youth in the colder tracts, this would probably have some influence on their growth and for that reason it would have been desirable also to have a representative collection from those coasts.

b. Methods of age-determination.

For age-determination of the Coalfish, like other species of the genus *Gadus*, various of the hard elements as scales, bones and otoliths can be used, but as in the case of the Haddock the most convenient objects for collecting and examining are the scales, which very much resemble those of the Haddock (cfr. Fig. Nr. 1 in this paper and Fig. Nr. 2 in my above cited Haddock-paper). For the purpose I

[1] About these and other places mentioned beneath I can refer to my paper: The Age and Growth of the Haddock etc. page 4—5 and Fig. 1 (the map).

have only used the scales from the sides of the fish, taken just above the lateral line under the second dorsal, as I also did when dealing with the Haddock [1], and in the case of the Coalfish the trawl will as a rule not tear off the scales of the sides of the fish, as they are comparatively firmly fastened in the skin.

As when dealing with the Haddock I have collected most of the scales used personally, put them in paper-envelopes and dried them instantly. For examination they need no other preparing than soaking in water and cleaning from adherent remainders of the skin. As in other cases I have used abt. twenty- and fifty-fold enlargement (Zeiss' microscope oc. 2, obj. a^2 and A), the lower power for ordinary reading, the higher one for counting the rows of sclerites etc.

The young Coalfish will begin forming their first scales when abt. four months old or some 45 mm. long. The scales grow pretty irregularly, forming broad summer-zones with 10—25 rows of sclerites and comparatively narrow winter-zones with 2—5 rows of sclerites in the 4—6 first years, later on the growth slows down. On the whole the scales are very much like those of the Haddock but are easier to read, as they are more transparent and the winter-zones usually more distinct. The first 8—10 years are as a rule well marked, so that the younger scales will afford reliable reading, but older scales will be more opaque and with more effaced growth-marks, which will not allow any accurate reading and in some cases cause a possible error of 1 or 2 years. — But all this only applies to normal scales; as when the Haddock is concerned, "blank" scales are fairly common in the Coalfish; this "blankness" of the Coalfishscales is commonly restricted to the first 1—2 years, but can extend to 4—5 years, and until 50—60 % of the scales in one sample and sometimes even all may be blank. No difference as to the locality is perceivable. Secondary or false winter-rings are not uncommon and will sometimes make the correct reading difficult.

Fig. 2. Otoliths. A. *Gadus callarias*, B. *Gadus virens*. Abt. x 1½. *f* fore-end, *u* upper edge.

Besides using the scales for age-determination, I have done a fairly extensive counting of the rows of sclerites as this will prove a good method for studying the seasonal changes in the growth and in connection with this I will point out that small or dwarfed scales, with very few rows of sclerites in each year-zone, often are to be found among the larger ones and give no right idea of the progress of the annual growth.

In very few cases I have used the otoliths for age-determination. Broken over in the middle and the surface of fracture smoothed, i. e. treated in the same manner as when the Cod is concerned. (cfr. my paper on the age and growth of that fish) they will afford a pretty clear reading and are in shape and other properties much resembling those of the Haddock (Fig. 2, B). Of other objects fit for age-determination I have made no use, but I have carried out on a large scale measurement of the length of the fish of the youngest year-groups (0-III-group) (the Petersen-method) and found it very reliable and plain, as far as these groups are concerned.

c. Treatment of the material.

When dealing with the Cod and the Haddock I found it suitable to treat the material from each of the five sections of the coast separately, but young and old fish jointly, as they often were caught in the same place and at the same time. In the case of the Coalfish the young and the older fish are seldom

[1] As to the Haddock, THOMPSON in his paper "Problems in Haddock Biology I" claims that the best scales for the measurement of the annual growth are those from the region below the third dorsal (cfr. my above cited paper on the age and growth of the Haddock, p. 7). But as in the case of the Haddock I have not tried to calculate the growth of the Coalfish from the scales, so the place where they are taken will not matter.

Table I. Coalfish captured in inshore waters from the "Thor" and the "Dana" 1904—1924.

Locality Depth and Date D = "Dana" Th = "Thor"	Vestmann Isles, S. 10—3 m. 6. VI. 1908, Th.	Hafnarfjord, SW. 11—6 m. 13.—14. VI. 1924, D.	Patreksfjord, NW. 25—0 m. 22.—26. VI. 1904, Th.	Seydisfjord, 30—0 m. 4. VI. 1924, D.	Hafnarfjord, SW. 10—0 m. 4.—6. VII. 1904, Th.	Siglufjord, N. 6—0 m. 6. VIII. 1905, Th.	Nordfjord, E. 10—0 m. 30. VII. 1924, D.
Length cm.	a	b	c	d	e	f	g
40	..	..	..	..	..	..	..
39	1	..	..	..	..	..	..
38	4	..	..	..	..	..	..
37	8	..	..	..	..	..	..
36	5	..	..	..	2	..	..
35	8	..	..	..	..	..	..
34	2	..	..	..	1	..	..
33	1	..	..	..	7	..	..
32	2	3	3	3	7	..	..
31	..	5	1	8	9	..	..
30	..	4	1	26	3	..	..
29	..	7	..	31	2	..	..
28	..	1	..	50	1	1	..
27	..	1	1	41	..	1	..
26	..	..	..	35	..	4	..
25	..	..	..	13	..	4	..
24	2	..	..	5	3	3	..
23	4	..	..	..	4	3	..
22	4	..	..	..	11	4	..
21	9	3	1	..	12	10	..
20	11	5	3	..	26	7	1
19	10	10	4	7	32	5	..
18	23	30	9	28	47	5	4
17	14	52	10	63	55	1	5
16	11	63	13	87	51	2	11
15	17	93	8	114	22	..	12
14	..	108	22	78	10	..	5
13	..	89	22	28	3	..	1
12	..	40	25	3	1	..	..
11	..	7	11	1	..	..	..
10	..	2	6	..	..	..	..
9	..	..	..	..	..	..	..
8	..	..	..	..	5	..	..
7	..	..	..	..	57	4	..
6	..	..	..	..	113	5	3
5	..	1	..	..	43	15	2
4	..	6	21	..	17	13	1
3	..	6	4	..	5	5	..
2	..	..	..	..	2	1	..
1	..	..	..	..	..	..	..

Table II. Coalfish captured in inshore waters by the author 1904—1909.

Locality Depth and Date	Faxa Bay, 20—0 m. 24. VII.—18. VIII. 1909.	Breidafjord, 12—0 m. 6.—20. VII. 1909.	Isafjord Deep, 40—0 m. 10.—17. VII. 1908.	Huna Bay, 16—0 m. 31. VII.—10. VIII. 1908.	Reykjavik, 10—6 m. 13.—14. II. 1904.
Length cm.	a	b	c	d	e
30	..	..	..	..	..
29	..	..	..	..	..
28	1	..	..	..	..
27	1	..	..	..	..
26	..	..	..	..	..
25	6	..	..	..	..
24	12	..	..	..	..
23	8	2	3	..	..
22	9	3	6	..	..
21	9	4	6	..	..
20	..	11	12	1	..
19	..	9	16	..	..
18	..	9	22	2	..
17	..	20	18	2	..
16	..	14	8	..	2
15	..	4	4	..	16
14	..	1	2	..	80
13	1	1	..	..	181
12	3	..	..	..	233
11	8	..	..	..	226
10	45	1	..	1	134
9	83	23	..	6	81
8	127	84	2	28	6
7	141	121	13	126	1
6	191	208	64	222	..
5	129	423	167	121	..
4	47	334	259	121	..
3	3	305	117	83	..
2	..	44	2	2	..
1	..		..	..	..

captured in that way, the youngest groups being caught in shallow inshore waters at very different times and on all coasts of the country, whilst the older ones only are caught in offshore waters (mostly in the trawl) and only on a limited portion of the coast. For this reason I prefer to treat the young and the older fish separately, thinking it will give a clearer view of the matter.

aa. Young fish (0-III-group).

As recorded above, I have both measured many thousands af young Coalfish myself and (thanks to Professor SCHMIDT's liberality) had the opportunity to see the results of the extensive measurements carried out onboard the Danish research-vessels all round the coast, and besides this I have collected scales from abt. 600 specimens from different places on the coasts.

Now I will give a brief account of the more important of the measurements and show how they illustrate the age and the growth of the young fish and then, for the sake of comparison, add the results of the scale-readings.

1. Coalfish captured in inshore waters in eel-seines or other small-meshed seines, in different years, all round the coast, from Danish research-vessels, Table I, and by the Author, Table II.

From these Tables, which show the results of the measurement of great numbers of young fish, it will be seen that the fish from the particular localities separate them in very distinctly marked groups, which evidently are year-groups with one year's difference in age between two neighbour-groups. In most of the cases the groups are two, in some few (Table I, *b*, *c* and *d*) three and in one case (Table II, *e*) only one. When the length of the fish belonging to each year-group is compared with the figures given below (Table III—V), which are found by examination of the scales, it leaves no room for any doubt, that the year-groups in question are representing the youngest two or three subsequent years, i. e. the 0-group, the I-group and the II-group, with their mean size in the vicinity of the length of the individuals that are most numerous in each group. As these figures are very clearly illustrative of the growth-rate of the young Coalfish in different places round Iceland, they give no cause to any further consideration in this connection, but will be treated from another point of view later on.

2. Coalfish captured in inshore or shallow waters, with different fishing apparatus by Danes and Icelanders, in various places, all round the coast, in different years and seasons.

This material, which consists of abt. 600 specimens has been used by the Author for age-determination of the young (inshore-living) fish. As mentioned above, the most convenient objects for this purpose are the scales, which have also almost exclusively been used. Very seldom the delicate and thin scales of the young fish have given me any trouble as to accurate reading, and in such cases I have taken refuge to the otoliths as good objects for checking the scale-reading. — This rather scanty material gives no cause for any dividing of it into separate groups, according to the places of capture (the most important of them having been mentioned above), for which reason I will content myself with referring to the results shown in the Tables III—V, which are recording the catches in the particular localities and to the results of the age-determinations of those catches.

In the Table III are recorded catches from three places on the south side of Isafjord Deep. In many of the specimens recorded in the first section of the Table, the sex was not distinguishable, as they were caught in my absence and had become decayed when I examined them. In this section are the three first year-groups (0—II group) present and quite separated from each other, with their mean length abt. 8.1 and 30.4 cm. and the range of variation rising from 6 cm. in the 0-group to 14 cm. in the II-group. The III-group is entirely absent. — In the second section of the Table three year-groups are also present, viz. the II-, III- and IV-group. Although caught at the same time of the year the size of the II-group, which is present in both sections, is comparatively much greater in the second section (mean length 34.5 cm.), in spite of the fact, that the locality (Alftafjord) is more remote from the open sea, than are the two others. But this is probably due to the fact, that all the fish in this section were taken together with medium-sized Herring, which they had followed from the open sea outside the firths. The largest specimens of the II-group then surely must already have moved from the coastal waters to the open sea and there joined the still larger fish of the III-group, in accordance with the rule, that young fish growing up in

Table III. Coalfish from the NW.-coast.

Locality	A. Isafjord, Bolungavik 29. VII.—10. VIII. 1923, hand-lines									Locality	B. Alftafjord 29. VII. 1915, purse-seine					
Age-group	0			I			II			Age-group	II		III		IV	
Sex	♂	?	♀	♂	?	♀	♂	?	♀	Sex	♂	♀	♂	♀	♂	♀
Length cm.										Length cm.						
40	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..
39	..	..	..	..	..	..	..	..	..	54	..	..	..	..	1	..
38	..	..	..	..	..	..	..	..	..	53	..	..	..	..	2	..
37	..	..	..	..	..	..	1	..	..	52	..	..	..	..	..	1
36	..	..	..	..	..	..	..	..	1	51	..	..	..	..	..	..
35	..	..	..	..	..	..	..	..	..	50	..	..	..	1	..	..
34	..	..	..	..	..	..	2	1	2	49	..	..	1	..	1	1
33	..	..	..	..	..	..	6	..	1	48	..	..	2	1	..	..
32	..	..	..	..	..	..	4	..	4	47	..	..	1	5	..	..
31	..	..	..	..	..	..	9	2	5	46	..	..	2	1	..	..
30	..	..	..	..	..	..	9	2	4	45	..	..	..	2	..	..
29	..	..	..	..	..	..	6	3	3	44	..	..	5	2	..	..
28	..	..	..	..	..	..	2	2	4	43	..	..	1	..	1	..
27	..	..	..	..	..	..	1	..	2	42	..	..	1	1	..	..
26	..	..	..	..	..	..	..	..	..	41	..	..	1	..	..	..
25	..	..	..	2	..	1	1	..	..	40	..	..	..	..	..	..
24	..	..	..	1	1	2	1	..	..	39	..	..	..	..	..	..
23	..	..	..	7	2	8	..	..	..	38	..	..	1	..	..	..
22	..	..	..	6	3	6	..	..	..	37	1	..	..	..	..	..
21	..	..	..	10	4	8	..	..	..	36	..	..	2	..	..	..
20	..	..	..	7	7	9	..	..	..	35	..	..	..	..	..	..
19	..	..	..	4	5	5	..	..	..	34	2	..	2	1	..	..
18	..	..	..	3	3	2	..	..	..	33	2	..	..	..	..	..
17	..	..	..	3	..	..	..	..	..	32	..	..	..	..	..	..
16	..	..	..	..	3	..	..	..	..	31	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	30	..	1	..	..	..	..
14	..	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	27	..	..	..	..	..	..
11	..	1	..	..	..	..	..	..	..	26	..	..	..	..	..	..
10	..	6	..	..	..	..	..	..	..	25	..	..	..	..	..	..
9	..	8	..	..	..	..	..	..	..	24	..	..	..	..	..	..
8	..	14	..	..	..	..	..	..	..	23	..	..	..	..	..	..
7	..	13	..	..	..	..	..	..	..	22	..	..	..	..	..	..
6	..	2	..	..	..	..	..	..	..	21	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..
Average length	8.1			20.9	19.9	20.9	31.1	29.9	32.0	Average length	34.5	30.0	35.6	44.3	46.1	50.4	50.5
				20.6			30.4				34.5			45.1		50.4	

shallow water will move to the open sea, when having reached a certain size[1], irrespective of the age. The large fish of the III-group and the IV-group in this section may be regarded as belonging to the open sea and only visiting the coastal waters when tempted like the Herring by shoals of food-animals, in this case *Ammodytes lancea* and *Rhoda inermis* (the favorite-food of the larger Coalfish).

Table IV deals with young fish from Faxa Bay, partly captured in shallow inshore water in autumn and mid-winter, partly in shallow (35 m.) offshore water on the famous fishing ground Svid (Dana St. 2442). The catches from Hafnarfjord show two year-groups, the 0- and the I-group, as they

[1] Lee, Rosa M. Age and Growth Determination in Fishes. Nature. Vol. 106, p. 49.

Table IV. Coalfish from the SW.-coast (Faxa Bay).

Locality	Hafnarfjord 2. II. 1909, Seine				Reykjavik 10. IX.—15. X. 1912, Seine								Svid 30. VII. 1925, Trawl					
Age-groups	0		I		I		II		III		IV		II		III		IV	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.																		
57	..	..	..	..	..	..	..	..	..	1	.....		..	..	..	..	..	..
56	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	..	1
47	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
43	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..
42	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	..
41	..	..	..	..	....	2	..	..	..	..	..	..	..	..	..	..	..	..
40	..	..	..	..	..	2	..	..	..	..	..	..	1	..	..	..	..	..
39	..	..	..	..	..	1	..	..	..	..	..	..	..	4	..	..	..	..
38	..	..	..	..	..	..	..	..	..	..	..	..	3	1	..	..	..	..
37	..	..	..	..	..	2	..	..	..	..	..	..	2	5	..	..	..	..
36	..	..	..	..	..	..	..	..	..	..	..	..	8	2	..	..	..	..
35	..	..	..	..	..	..	..	..	..	..	..	..	8	5	..	..	..	..
34	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	..	..	..
33	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
32	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	4	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	3	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	4	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	1	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average length	14.4		25.2		26.6		41.2		56.0		57.0		36.5	36.6	48.0	47.0		
													37.3		47.5		48.0	

just have finished the growth-period and some of the largest of the II-group possibly already have moved from the coast out to deeper water during the cold season, whilst that from Reykjavik shows the comparatively great size the individuals of the II-group have obtained already before the middle of October, when

the growth-period however, is not at its end. — The catch made by the "Dana" on the Svid makes good that plenty of the II-group, ranging in size from 32 to 42 cm. (mean length abt. 37 cm.) is to be found far off shore (some 8—15 miles) in midsummer, in company with some few individuals of the III- and IV-group.

In Table V are recorded fish captured on the N.- and E.-coasts in mid-summer. In both places only two groups, the II- and the III-group are present, in both places for the same purpose, viz. to gorge

Table V. Coalfish from the N. and E.-coast.

Locality	A. Siglufjord 19. VII. 1924, Eel-seine				B. Nordfjord 5.—6. VIII. 1926, Hand-line			
Age-groups	II		III		II		III	
Sex	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.								
46	..	..	..	..	..	..	..	..
45	..	..	1	..	..	..	..	..
44	..	..	..	..	..	..	..	..
43	..	..	1	1	..	..	..	..
42	..	..	..	..	..	..	..	2
41	..	..	..	1	..	..	4	8
40	..	..	..	..	..	..	5	3
39	..	..	..	..	..	..	8	4
38	..	..	..	..	..	..	5	5
37	..	..	..	..	..	..	4	8
36	..	1	..	..	..	..	17	6
35	1	..	..	..	..	..	4	5
34	..	..	..	..	..	..	..	4
33	3	2	..	..	..	..	1	3
32	2	3	..	..	..	..	1	1
31	4	2	..	..	1	..	..	..
30	..	3	..	..	1	1	..	..
29	2	1	..	..	..	..	..	..
28	..	1	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..
Average length	31.7	31.3	44.0	42.0	30.5	30.0	37.4	37.8
	31.5		43.0		30.3		37.6	

on the offal of fish, thrown into the sea from the wharfs. All stomachs were crammed with this offal. As to the age-groups in each place it will be seen that the number of individuals in the particular groups is quite the reverse in each place, the II-group being predominant in Siglufjord, the III-group in Nordfjord, while the III-group is very scanty in the former place, the II-group in the latter. Here it was mixed with the III-group, which had stayed in vast number for a couple of weeks in the firth, but older fish, I was told, never visited the firth.

The marked difference in size between the particular year-groups in the various places round the coast will be made an object of further consideration beneath.

bb. Older fish (III-group and upwards).

As mentioned above I have got scale-samples from mediumsized and large fish, collected in five different places off the warmer coasts of Iceland, viz.

106 samples from the SE.-coast.
14 — — — S.- —
145 — — — S.W- —

266 samples from the NW.-coast.
531 — total.

As in my other papers on Age and Growth, I will also this time treat the material from the particular sections separately.

α. The South-east coast.

The material from this section consists of scale-samples from 106 fishes collected onboard the "Skallagrimur", off Eystra Horn, 23rd—26th of April 1925. The results of the treatment of this material will be seen in the following Table VI.

No fish younger than five years is represented in this Table, and the youngest group, the V-group, is pretty small only counting 10 specimens (mostly males), ranging in length from 65 to 77 cm., with an average length of 69.6 cm. — The VI-group is a little more numerous (mostly females), ranging from 66 to 84 cm., mean length 74.0 and the annual increase 4.4 cm. — The VII-group is tolerably well represented (both sexes) and ranges from 70 to 89 cm., mean length 78.6 cm., annual increase 4.6 cm. — The VIII-group again is a little scarcer and, as is often the case with the middle-aged (VII—X-) groups of this fish, much varying as to the size of the individuals; in this case the range of variation in length is from 70 to 100 cm., whereas the average length is 83.3 cm. and the annual increase 4.7 cm. — The IX-group is, like the remaining ones, rather scanty; it ranges from 72 to 102 cm., with an average length of 91.3 and 8.0 cm. annual increase. — The X-group ranges from 83 to 104 cm.; mean length 92.2, annual increase 0.9 cm. — The very poor XI-group ranges from 96 to 106 cm.; mean length 101.5 cm., average annual increase 9.3 cm. The two last means are, owing to too scanty material, evidently no true expression for the real circumstances and in the higher (XI—XII) groups, which are ranging in length from 97 to 109 cm. I was unable to read the years with certainty, so that I shall not take them into any further consideration.

Regarding the particulars given in this Table I will refer to page 20, where these are put down in one General-table together with the particulars in the other Tables (except Table VIII), for an easier comparison. The lack of material belonging to the youngest year-groups, to which the attention was drawn above, makes it impossible to give any clear idea of the course of growth of the fish from this part of the coast; but the particulars given indicate that the period of the quickest growth has been passed at the age of five years, as the average annual increase after that year is rather small (the marked irregularities, as in the X- and XI-group are, no doubt, due to the scantity of material), which will be quite intelligible, as most of the fish (all over 70 cm.) were mature.

As nothing is known about the tract where the fish in question have spent their first years of life, it would not be easy to imagine their course of growth (draw the growth-curve) from the very beginning, for it would make a considerable difference, whether the fish had spent their "youth" in the cold water on the E.-coast or in the warmer one on the S.- or SW.-coast. One could imagine that the number of the rows of sclerites in the different year-zones on the scales might give some information as to this matter, but unfortunately this is not the case (cfr. Table, page 22).

β. The South- and South-west coasts.

As recorded above the material from this section consists of scale-samples from 161 fish, the greatest part of which was collected onboard the "Skallagrimur" on the Selvog's Bank March 25th to April 3rd 1927 and April 19th 1928, the remainder at the Westman Isles (Drangar) August 15th 1919 and on Dritvikur grunn, abt. 8 miles off Snæfellsnes, May 7th 1927.

The results of the treating of the material from these three localities will be displayed in the two following Tables, of which the first one only will be made an object of any closer consideration.

As in the case of the material from the SE.-coast no fish younger than five years old proved to occur in the material from the Selvog's Bank. — The youngest group in question, the V-group, is fairly well represented especially the males; it ranges in length from 65 to 81 cm., average length 73.2 cm. — The VI-group is also pretty numerous; it ranges from 72 to 86 cm., has the mean length of 78.7 cm.,

Table VI. Coalfish from the SE.-coast, off Eystra-Horn, April 1925.

Age-groups	V		VI		VII		VIII		IX		X		XI		XI—XII		XII—XIII	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.																		
110	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
109	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
108	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
107	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
106	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..
105	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1
104	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
103	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
102	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..
101	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..
100	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
99	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..
98	..	..	..	..	..	..	..	..	..	2	..	..	..	1	..	1	..	..
97	..	..	..	..	..	..	..	..	..	..	1	2	..	..	1	..	..	..
96	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..
95	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
94	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
93	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
92	..	..	..	..	..	..	1	1	..	1	..	..	..	..	..	..	..	..
91	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..
90	..	..	..	..	..	..	..	2	..	2	1	..	..	..	..	..	..	..
89	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
88	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
87	..	..	..	..	..	..	..	..	1	..	1	1	..	..	..	..	..	..
86	..	..	..	..	2	1	1	..	..	..	..	..	..	..	..	..	..	..
85	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
84	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..
83	..	..	..	..	..	1	..	1	..	1	1	..	..	..	..	..	..	..
82	..	..	..	..	2	3	..	1	..	..	..	..	..	..	..	..	..	..
81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
80	..	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..
79	..	..	..	1	..	5	..	1	..	..	..	..	..	..	..	..	..	..
78	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
77	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
76	1	..	..	..	..	..	2	1	..	..	..	..	..	..	..	..	..	..
75	1	..	..	1	1	2	..	..	..	..	..	..	..	..	..	..	..	..
74	..	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..
73	..	..	1	1	1	2	1	..	..	..	..	..	..	..	..	..	..	..
72	1	..	1	2	..	1	..	..	1	..	..	..	..	..	..	..	..	..
71	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..
70	2	..	..	1	..	1	..	1	..	..	..	..	..	..	..	..	..	..
69	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
67	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
65	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
63	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average length	71.2	65.3	70.3	75.0	80.8	77.5	83.2	83.4	89.2	93.1	90.2	96.2	104.0	97.0	97.0	104.3	99.0	105.0
	69.6		74.0		78.6		83.3		91.3		92.2		101.5		102.5		102.0	

and an average increase of 5.5 cm. — The remaining groups are not numerous; the VII-group ranges from 78 to 98 cm., has the mean length of 88.9 cm. and 10.2 cm. annual increase. — The VIII-group ranges from 80 to 104 cm.; average length 92.8 cm. and the annual increase 3.9 cm. — As to the remaining groups I was unable to separate the single years accurately; for that reason I shall not take them into any further consideration, but content me with referring to the Table and as to the summary of this I will refer to the General-Table, page 20.

The second Table (Table VIII) only comprises 38 fish pretty different in regard to place of capture and the season when captured and to age too, as those caught at the Westman Isles are all old, the

Table VII. Coalfish from the SW.-coast, Selvog's Bank, March and April, 1927—1928.

Age-groups	V		VI		VII		VIII		VIII—IX		IX		X		X—XI[1])		XII	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.																		
117	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
116	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
115	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
114	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..
113	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
112	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
111	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
110	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
109	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..
108	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
107	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
106	..	..	..	..	..	..	..	..	1	1	..	..	..	..	1	..	..	..
105	..	..	..	..	..	..	..	..	2	1	..	..	..	1	..	..	..	..
104	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..
103	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..
102	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
101	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
100	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
99	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
98	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..
97	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
96	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..
95	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..
94	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
93	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
92	..	..	..	..	..	1	..	3	..	..	..	..	..	..	..	..	..	..
91	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
90	..	..	..	..	2	2	..	1	..	..	..	..	..	..	..	..	..	..
89	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
88	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
87	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
86	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
85	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..
84	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
83	..	..	3	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..
82	..	..	1	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..
81	1	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
80	2	..	5	2	1	..	..	1	..	..	..	..	..	..	..	..	..	..
79	1	1	3	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..
78	2	2	..	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..
77	..	1	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
76	..	1	1	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
74	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
73	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
71	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
69	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
67	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
65	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
63	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average length	72.3	76.9	78.8	78.5	89.1	88.3	102.0	89.4	102.5	104.5		115.0	104.0	105.0	108.5	113.0	114.0	113.0
	73.2		78.7		88.9		92.8		103.1				104.5		110.7		113.5	

[1]) One 121 cm. long ♀ of the XI-group is not shown in the Table.

others only 3—4 year's fish. In spite of this difference I found it convenient, on account of the scantity of this material, to put it all down in one table, yet separated in two sections, A and B.

These two sections will give no cause for any closer considerations. The 14 specimens in Section A belong to four different year-groups and agree fairly well with their coevals in Table VII, when their

Table VIII. Coalfish from A. the S.-coast, Westman-Isles, August 1919 and B. the SW.-coast, Dritvikur-grunn, May 1928.

Age-groups	III		IV		VIII		IX		X		XI	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
A. Length cm.												
118	..	..	..	..	..	..	..	..	..	..	..	..
117	..	..	..	..	..	..	..	..	..	1	..	..
116	..	..	..	..	..	..	..	..	..	..	..	..
115	..	..	..	..	..	..	..	..	..	..	..	..
114	..	..	..	..	..	..	..	..	..	..	1	..
113	..	..	..	..	..	..	..	..	..	..	..	..
112	..	..	..	..	..	..	..	..	..	..	..	..
111	..	..	..	..	..	..	..	..	..	..	..	..
110	..	..	..	..	..	..	1	..	1	..	..	..
109	..	..	..	..	..	..	..	..	..	..	..	..
108	..	..	..	..	..	..	1	..	1	..	..	..
107	..	..	..	..	..	..	..	..	..	..	..	..
106	..	..	..	..	..	..	..	1	..	..	..	..
105	..	..	..	..	..	..	..	..	2	..	..	..
104	..	..	..	..	..	..	..	..	..	..	1	..
103	..	..	..	..	..	..	1	..	..	..	1	..
102		..	..	..	..	..	1	..	..	..	..	..
101	..	..	..	..	..	..	..	..	..	..	..	..
100	..	..	..	..	..	..	..	..	..	..	..	..
99	..	..	..	..	..	1	..	..	..	..	..	..
98	..	..	..	..	..	..	..	..	..	..	..	..
Average length						99.0	105.8	106.0	107.0	117.0	107.0	
							105.8		109.0			

Age-groups	III		IV	
Sex	♂	♀	♂	♀
B. Length cm.				
65	..	..	..	..
64	..	..	1	..
63	..	..	..	..
62	..	..	..	..
61	..	..	1	..
60	..	..	..	1
59	..	..	..	..
58	..	..	..	..
57	..	..	2	2
56	..	..	2	..
55	..	..	1	1
54	..	..	..	..
53	..	..	..	..
52	..	1	..	1
51	1	..	1	1
50	1	..	2	..
49	..	..	..	1
48	1	..	1	..
47	..	1	..	..
46	..	..	..	..
45	..	..	..	..
44	..	..	..	..
43	..	1	..	..
42	..	..	..	..
Average length	49.7	47.3	55.0	54.1
	48.5		54.8	

being in the middle of the growth-period, while the others are at the beginning of it, is remembered. — The 24 specimens contained in section B are all young fish of the III- and IV-group, and as they, like the material treated in Table VII, are captured at the beginning of the growth-period, they are comparable with that material and show (the IV-group.) clearly a continuation downwards from the youngest group (the V-group) in Table VII, with a little gap though due, perhaps, to a slower growth in a cooler water or to the absence of the largest of the group. The III-group of this section looks as if the individuals were the largest ones of that year-group (cfr. page 14) and therefore comparatively too large.

γ. The North-west coast.

From this section of the coast I have got the richest material, 266 samples of scales, collected in two localities, viz. 100 in the mouth of Isafjord Deep, caught on long-line by a motor-boat in 100—120 m. depth, 3rd—8th of August 1923, and 166 by the "Skallagrimur" in 180—200 m. on the famous fishing ground Hali, on the very edge of the "continental shelf" of Iceland, 45—50 miles off the headlands on boths sides of Isafjord Deep, August 21st to September 12th 1925. — As this material is collected in different localities, I find it more adequate to treat each portion separately (in Table IX and X).

The Table IX includes fish of very different size and age, from the limits between small and medium-sized individuals up to the largest known in Icelandic waters; but of medium-sized fish there are only very few, whereas the majority is very large fish (over 90 cm.) that evidently had been

Table IX. Coalfish from the NW.-coast off Isafjord Deep, August 1923.

Age-groups	III		IV		V		VI		VII		VIII		IX		X		X—XI		XI—XII		XIII-XIV	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.																						
120	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
119	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
118	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
117	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
116	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	1	..	..	..	..
115	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
114	..	..	..	..	..	..	..	..	..	..	1	2	..	..	1	..	..	..	..	..	..	..
113	..	..	..	..	..	..	..	..	1	..	..	1	1	..	1	1	..	2	1	..	..	..
112	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..
111	..	..	..	..	..	..	..	..	..	..	2	..	..	2	1	..	..	..	..	..	..	..
110	..	..	..	..	..	..	..	..	..	..	1	1	2	4	..	..	..	..	..	..	..	..
109	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	1	..	..
108	..	..	..	..	..	..	..	..	..	..	1	..	2	1	1	..	1	..	..	..	..	..
107	..	..	..	..	..	..	..	..	..	..	2	..	2	2	1	..	..	..	..	1	..	..
106	..	..	..	..	..	..	..	..	1	..	..	..	2	1	..	..	..	..	..	..	..	..
105	..	..	..	..	..	..	..	..	1	..	..	1	1	1	1	..	..	..	..	..	..	..
104	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	1	..	..	..
103	..	..	..	..	..	..	..	..	1	..	..	1	1	..	1	..	..	..	..	..	..	..
102	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
101	..	..	..	..	..	..	..	..	1	..	1	..	1	..	..	1	..	..	..	..	..	..
100	..	..	..	..	..	..	..	..	..	..	1	..	4	..	..	..	..	..	..	..	..	..
99	..	..	..	..	..	..	..	..	..	..	1	..	..	2	..	..	..	..	..	..	..	..
98	..	..	..	..	..	..	1	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..
97	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
96	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..
95	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..
94	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..
93	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..
86	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
77	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
73	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
71	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
69	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
67	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
63	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
55	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average length	68.0	59.6		68.5	73.0		86.2	86.0	102.1	93.0	103.3	109.2	105.1	106.5	108.7	107.0	110.0	113.5	111.7	110.3		119,0
	57.4						86.2		101.1		106.2		105.8		108.3		112.2		111.0			

chasing the large Herring which was present in great shoals on the grounds where the Coalfish was captured; and this large Herring has, no doubt, been too big for the more small-sized Coalfish and therefore not so attractive for it (which only can manage to devour the medium-sized and small Herring) as for the larger fish, which commonly had one or two of these large Herrings in their stomachs. — On account of this scantity of material belonging to the III—VI group, I will leave them quite out of consideration. — The VII-group is the first worth mentioning, yet only 9 specimens all, save for one, males. The range of variation in length in this group is 93—113 cm. (20 cm.) and the average

Table X. Coalfish from the NW.-coast, Hali, August—September 1925.

Age-groups	III		IV		V		VI		VII		VIII		IX		X		X—XI		XII	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.																				
107	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1	..
106	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
105	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
104	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..
103	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
102	..	..	..	..	..	..	..	..	..	1	..	..	1	..	1	..	..	1	..	..
101	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..
100	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1	..	..	..	..
99	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..
98	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
97	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
96	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..
95	..	..	..	..	..	..	..	..	..	..	2	..	1	..	..	..	..	..	..	..
94	..	..	..	..	..	..	..	..	1	1	..	1	..	..	..	..	..	..	..	..
93	..	..	..	..	..	..	..	..	..	..	1	1	1	1	..	..	..	..	..	..
92	..	..	..	..	..	..	..	1	1	..	2	1	..	..	..	..	..	..	..	..
91	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..
90	..	..	..	..	..	..	..	1	1	3	1	1	..	..	..	..	..	..	..	..
89	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
88	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..
87	..	..	..	..	..	..	2	..	1	..	2	1	..	..	..	..	..	..	..	..
86	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
85	..	..	..	..	..	1	1	..	2	3	..	..	..	..	..	..	..	..	..	..
84	..	..	..	..	..	..	3	1	..	2	..	..	..	..	..	..	..	..	..	..
83	..	..	..	..	..	..	1	1	..	2	..	..	..	..	..	..	..	..	..	..
82	..	..	..	..	1	..	1	..	2	..	..	..	..	..	..	..	..	..	..	..
81	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	1	4	2	1	1	..	..	..	..	..	..	..	..	..	..
79	..	..	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..
78	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
77	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
76	..	..	..	..	..	..	1	2	1	1	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..
74	..	..	..	..	..	..	2	..	..	1	..	..	..	..	..	..	..	..	..	..
73	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..
71	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
69	..	..	1	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	..	..	..	2	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
67	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	..	..	..	1	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
65	..	..	7	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	6	6	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
63	..	..	4	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	1	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	..	..	2	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	10	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	..	..	5	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
57	..	..	5	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	1	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
55	2	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	3	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
53	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
51	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
47	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
46	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
45	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
42	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
40	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average length	51.3	49.5	61.0	60.3	71.9	70.3	80.7	81.5	84.2	85.0	91.8	91.1	97.8	98.2	101.7	102.5	107.0	104.5	107.0	
	50.6		60.6		70.7		81.1		84.6		91.6		98.0		102.1		105.7			

length 101.1 cm. — The VIII-group has still greater range of variation in length than its predecessor, viz. 94—117 cm., the mean length 106.2 and an increase in length from last year of 5.1 cm. — The IX-group ranges from 96 to 113 cm., has an average length of 105.8 cm. and a negative annual increase (i. e. a lesser mean length than the preceding group). — The X-group and the other remaining groups are too poor for giving any clear idea of the growth of the largest fish and the same might be said on the whole about the material treated in this Table. Yet it will be of some importance as completing that treated in Table X. — Otherwise the main items of this Table will be seen in the General-table, page 20.

The material recorded in the Table X includes fish of any age from 3 to 12 years (both inclusive) and may be looked on as a direct continuation of that treated in Table III, where the youngest groups are amply represented and will, in connection with the items recorded in Table IX give a quite clear picture of the growth of the Coalfish at Iceland. Most of the year-groups are quite well represented, as only the 2—3 last are very scanty. — The III-group, which counts 20 specimens, ranges from 40 to 55 cm. and has an average length of 50.6 cm., and supposing that the mean length of the II-group has at the same time been abt. 33 cm. (cfr. Table III), the annual increase should be abt. 17.6 cm. — The IV-group, which is amply represented, ranges from 46 to 69 cm. (variation 24 cm.), mean length 60.6 cm., average annual increase 10.0 cm. — The V-group ranges from 63 to 85 cm.; average length 70.7 cm., annual increase 10.1 cm. The VI-group ranges from 72 to 92 cm., mean size 81.1 cm., annual increase 10.4 cm., The VII-group ranges from 74 to 102, has an average length of 84.6 cm. and an annual increase of 3.5 cm. — The VIII-group ranges only 87 to 96 cm., mean length 91.6 cm., average annual increase 7.0. — The IX-group ranges from 93 to 102, mean length 98.0 cm., annual increase 6.4 cm. — The X-group (very poor) ranges from 99 to 106 cm., mean length 102.3 cm., annual increase 4.3 cm. — The older groups are too poor for any further treatment.

The main contents of the Tables dealing with the older Coalfish (the Tables VI—X) will be more easily comparable from the following survey, where the principal items given in the particular Tables are laid down in one General-Table, which is following.

By a little closer comparison it will, among other things, be seen, that the average size of the same year-groups from the particular localities is pretty different, especially in the medium-aged groups, the VI—X-group; this is most obvious, when the fish from the SE.-coast is compared to that from the S.- and NW.-coast, Table IX, the last-named being considerably larger; the same is also the case with the fish from the S.-coast, yet not so pronounced, and even, although in a still lesser degree, with the fish from the NW.-coast, Table X, that is, the fish from the SE.-coast proves to be comparatively lesser than is the fish from the other sections of the coast. In comparison with the fish from the NW.-coast it may to a certain degree be due to the fact, that these are captured in the latter half of the growth-period, whereas the fish from the SE.-coast are taken just at the beginning of it. But there must be given some other explanation, when the fish from the S.-coast is concerned, as these are captured earlier still than the others; either the fish in question must have originated from a slow-growing brood or is grown up in the cooler waters on the E.-coast which possibly might be proved by closer examination of the scales (i. e. by measurements of the single year-zones).

As another interesting fact I will point out the wide range of variety in the length (size) of the individuals in many of the age-groups, which often can rise to 20—30 cm. or even more. In some cases this may be due to misreading of the age, but probably in most cases it is (as when the Cod is concerned) a consequence of the mixing together of individuals grown up in different waters, of hatching at a different time in the same spawning period, of possible dropping of some winter-rings, or of a different nature of the individuals as to the speed of growth and to the size. As to the above mentioned wide range of difference in size in the single year-groups the Icelandic Coalfish agrees with the Norwegian Coalfish, which according to the measurements of Damas[1] in this regard exhibits comparatively as great variety as does the Icelandic Coalfish.

[1] Op cit. page 200—201.

Coalfish, medium-sized and grown-up, from offshore grounds, SE.-, S.-, SW.- and NW.-coast.

Age-groups	III	IV	V	VI	VII	VIII	IX	X	X—XI	XI—XII	XII—XIII
Table VI. S.E.-coast.											
Variation in length	..	..	65—77	66—84	70—89	70—100	83—102	83—104	96—106	97—109	99—105
Average length	..	..	69.6	74.0	78.0	83.2	91.3	92.2	101.5	102.5	102.5
Av. annual increase	..	..	..	4.4	4.0	5.2	8.1	0.9	9.3	..	..
Table VII. S.-coast.											
Variation in length	..	..	65—81	72—86	78—98	80—104	95—114[1]	104—105	106—121	..	..
Average length	..	..	73,2	78,7	88.9	92.8	103.1	104.5	110.7	..	..
Av. annual increase	..	..	..	5.5	10.2	3.9	10.3	1.4	6.2	..	..
Table VIII A & B. S.- & S.W.-coast.											
Variation in length	43—52	48—64	..	..	..	..	102—110	105—117	..	..	..
Average length	48.5	55.3	..	..	..	..	105.8	108.5	..	..	..
Av. annual increase	..	..	..	..	..	..	..	..	..	..	..
Table IX. N.W.-coast.											
Variation in length	45—58	..	..	63—98	93—113	94—117	96—113	101—114	108—116	104—118	..
Average length	57.4	..	..	82.5	101.1	106.2	105.8	108.3	112.2	111.0	..
Av. annual increase	..	..	..	..	..	5.1	..	2.5	3.9	..	..
Table X. N.W.-coast.											
Variation in length	40—55	46—69	63—85	72—92	74—102	87—96	93—102	99—106	102—107	..	..
Average length	50.6	60.6	70.7	81.1	84.6	91.6	98.0	102.3	105.3	..	..
Av. annual increase	..	10.0	10.1	10.4	3.5	7.0	6.4	4.3	3.0	..	..

[1]) VIII—IX-group.

Some marked irregularities in the growth of the fish from some of the sections is surely due to insufficient material, otherwise the particulars of the Table will give no reason for any further meditations at present, as the contents of the entire section 4 (the treatment of the joint-material) will be shortly surveyed in the following summary.

d. Summary.

On account of the very different habitat of the youngest year-groups and the more advanced age-groups of the Coalfish, which make it impossible to capture them silmultaneously and by the same im-

Mean length of the particular year-groups in Tables I—V and VI—X.

Age-groups	0	I	II	III	IV	V	VI	VII	VIII	IX	X
Combination of Tables:											
Id + VB + VI	..	c. 15.5	28.0	37.6	..	69.6	74.0	78.0	83.2	91.3	92.2
Ia + VIIIB + VII	c. 2.0	18.9	35.9	48.5	55.3	73.2	78.7	88.9	92.8	103.1[1])	..
IIIA + IX	8.1	20.6	30.4	(57.4)	..	..	82.5	101.1	106.2	105.3	108.3
IIIA + X			34.5	50.6	60.6	70.2	81.1	84.6	91.6	98.0	102.1

[1] VIII- and IX-group not separated.

plements, as often may be practised when other sort of fish is concerned, I found it necessary to treat the young and the elder fish separately. This circumstance makes it more difficult to give any sufficiently accurate picture of the rate of growth of the fish from each of the particular sections of the coast, so

much the more as in the case of the material from three of the sections, the two youngest age-groups, the III-group and the IV-group, are almost quite lacking, and in one case the V-group as well. Yet if one wants to get an — only approximate — idea of the rate of growth in each section, it will be necessary to combine the items given in the Tables concerned treating the young and the older fish from each particular section.

For this purpose I shall now try to survey the material in the way spoken of above, putting the most important particulars, viz. the mean length of each year-group together in a table embracing the said particulars given in the Table I—V and in the tables VI—X, but as the age-groups beyond 10 years are not at all separated, they will be left out of consideration.

A glance at the Tables in question and at the figures indicating the mean length of the individuals recorded from each section of the coast will show that the rate of growth in average is very much like that of the Haddock (and the Cod as well), being fairly rapid in the first 3—4 years, slowing down when maturity sets in and then gradually declining. If the material from the different sections of the coast is to be compared, it must be borne in mind, that the material from the two first-named sections is collected at the beginning of the growth-period, whilst that from the two last-named sections is collected near the middle of it and must be comparatively some few cm., different in the different periods of age, in advance as to the size.

It was pointed out above (page 19) that the older fish from the SE.-coast was comparatively obviously lesser than that from the S.- and NW.-coast; this is also (it will be seen in the Table) the case with the fish of the youngest age-groups from the E.-coast, compared with those from the S.- and NW.-coasts. Thus on the whole the Coalfish proves to be subject to the same rule as are the others of its relatives (the Cod, the Haddock etc.), that the growth is more rapid in the warmer waters on the S.- and W.-coasts than in the colder ones on the E.- (and probably also the N.-) coast.

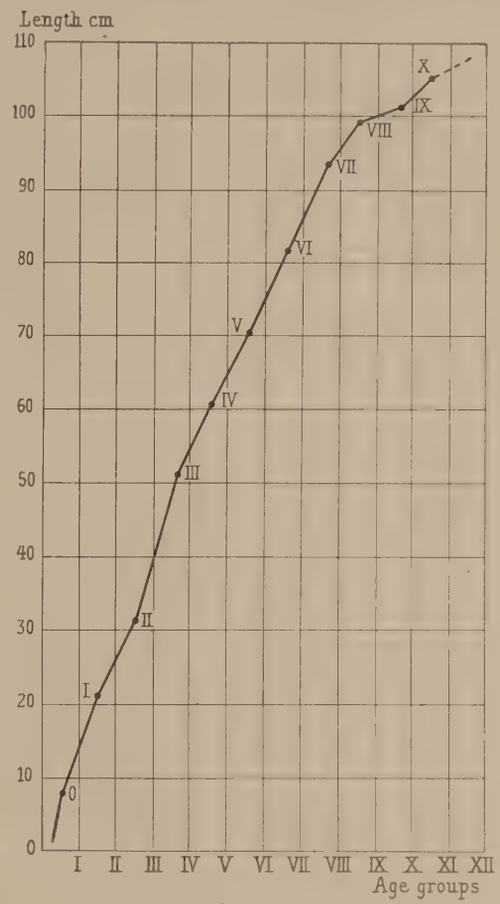

Fig. 3. Growth curve for Coalfish, North-west Coast of Iceland.

When the young fish from different localities is concerned, the difference is quite obvious, as will be seen if the figures in the Tables I (page 8), columns a—d and in Table II (page 8), columns a—c are compared. But because of the insufficient material I can not go farther in the comparison, neither verbally nor graphically. Instead of that I only shall try to give a graphical diagram (Fig. 3) of the average growth of the fish from the NW.-coast, recorded in the Tables III A, IX and X (Isafjord Deep and Hali), as perhaps representing the mean state of the matter, (which also was the case with the Haddock from this section of the coast[1] and the rate of the growth of the Coalfish proves also to be comparatively pretty much resembling that of the Haddock.

When the results of the above recorded investigations on the Age and the Growth of the Coalfish at Iceland are compared with those concerning this fish at Norway, it will be seen 1) that the size of the former does considerably surpass that of the latter. The size of the Norwegian Coalfish does somewhat

[1] Author: Age and Growth of the Haddock etc., page 20, fig. 3. As hinted at previously I have made no attempt to calculate the growth from the breadth of the year-zones, nor shall I do here.

exceed one metre and the weight 10 kg.[1], whereas the length of the Icelandic one may exceed 120 cm. and the weight rises to 15 kg.[2], 2) that the growth of the Norwegian Coalfish is on the whole slower than is the case with the Icelandic one, especially when the mature fish, even from the more southern regions, where it should be most rapid, is concerned[3]. Maturity sets also earlier in at Norway (cfr. beneath, page 24, footnote). On the other side the Norwegian Coalfish seems to grow older (18 years are recorded) than the Icelandic one; but on the present state of knowledge it will be too early to come to any definite conclusion about the matter.

2. Seasonal changes in the Growth.

I mentioned above, that the scales of the Coalfish are pretty much resembling those of the Haddock[4]; with regard to the aspect and arrangement of the rows of sclerites and their relation to each other

	SE.-coast 23—26/IV 25 (Table VI)	S-coast 25/III—3/IV 27 (Table VII)	S-coast 15/VIII 19 (Table VIII)	NW.-coast 3—8/VIII 23 (Table IX)	NW.-coast 21/VIII-12/IX 25 (Table X)
Length & sex.....	98 cm. ♀	109 cm. ♀	114 cm. ♀	111 cm. ♂	102 cm. ♀
Years 1.....	16 (13 + 3)	11 (7 + 4)	20 (17 + 3)	19 (15 + 4)	21 (19 + 2)
— 2.....	20 (15 + 5)	24 (16 + 9)	21 (18 + 3)	14 (12 + 2)	19 (16 + 3)
— 3.....	15 (12 + 3)	19 (16 + 3)	15 (12 + 3)	13 (11 + 2)	21 (17 + 4)
— 4.....	20 (17 + 3)	12 (10 + 2)	13 (11 + 2)	13 (11 + 2)	19 (15 + 4)
— 5.....	18 (16 + 2)	12 (10 + 2)	15 (13 + 2)	10 (7 + 3)	11 (9 + 2)
— 6.....	10 (7 + 3)	12 (10 + 2)	8 (6 + 2)	14 (12 + 2)	11 (9 + 2)
— 7.....	5 (3 + 2)	10 (8 + 2)	9 (7 + 2)	11 (9 + 2)	5—6
— 8.....	7 (4 + 3)	7 (5 + 2)	9 (5 + 4)	8 (6 + 2)	..
— 9.....	4 (2 + 2)	5 (4 + 1)	6 (5 + 1)	4—5	..
— 10.....	5 (4 + 1)	5 (4 + 1)	4 (2 + 2)	..	..
— 11.....	4 (3 + 1)	0	3 (2 + 1)	..	..
— 12.....	3 (2 + 1)	..	2	..	..
— 13.....	0	..	..	..	..

Faxa Bay, S.W.		Isafjord Deep, N.W.		Siglufjord, N.		Nordfjord, E.	
Size & Year	30/VII, 25	Size & Year	8-9/VIII, 23	Size & Year	19/VII, 24	Size & Year	5-6/VIII, 26
47 cm. 1	20 (18 + 2)	..	..	43 cm. 1	16 (12 + 4)	40 cm. 1	19 (17 + 2)
2	20 (18 + 2)	..	..	2	16 (13 + 3)	2	14 (9 + 5)
3	15 (14 + 1)	..	..	3	14 (10 + 4)	3	13 (12 + 1)
4	5	..	..	4	1—2	4	3—4
	2/X, 12		8—9/VIII 23				
44 cm. 1	15 (12 + 3)	37 cm. 1	17 (15 + 2)	30 cm. 1	15 (14 + 1)	30 cm. 1	16 (12 + 4)
2	26 (24 + 2)	2	17 (14 + 3)	2	10 (7 + 3)	2	15 (13 + 2)
3	15 (15 + 0)	3	6—7	3	5—6	3	6
	7/I, 24						
25 cm. 1	14 (11 + 3)	25 cm. 1	24 (21 + 3)	..	..	..	..
2	25 (24 + 1)	2	8	..	..	..	..
18 cm. 1	21 (20 + 1)	8 cm. 1	8	..	..	..	..

there is a good deal of resemblance, too. Also in the scales of the Coalfish there is so marked difference in the size and the development of the winter- and summer-sclerites, that it will give a pretty clear information about the progress of the growth through different seasons of the year (cfr. Fig. 1, A-C and the

[1] WOLLEBÆK, Norges Fisker, Kristiania 1924; page 131.
[2] AUTHOR, Synopsis, page 27, and present paper, Table VII.
[3] DAMAS, op. cit., Table, page 201, and Beretning om Torskearternes Naturhistorie, fra Kommission A, Bergen 1919, page 100.
[4] AUTHOR, On the Age and the Growth of the Haddock etc., p. 20.

Table beneath). As in the case of the Haddock I have counted the rows of sclerites in a considerable number of specimens from all sections of the coast and some of the results are put down in the table. Yet in some cases the examining has, owing to indistinct limits between year-zones or between summer- and winter-rows, been too difficult for giving any exact counting, and for that reason the figures claim for no absolute accuracy.

The upper section of the Table exhibits the number of rows of sclerites in scales of large, grown-up fish from five of the localities from which fish is treated above. The number of rows in each year-zone is very different; in the young age (the older part of the scales, until 6—7 years) they are usually more numerous than in the older age (the younger part of the scales), and in the winter-portion of each year-zone the rows are much fewer than in the summer-portion, a fact indicating that the growth must be much slower in the colder than in the warmer season and ceases altogether some time in the late winter. The commonly effaced limits between summer- and winter-portion shows that the growth must gradually slow down; on the other side the broad sclerites in the rows beginning each year-zone, which as a rule form a quite distinct limit between the alternate year-zones, shows that the growth every spring starts suddenly after the stand-still. From the figures in the two first columns of the Table it will be seen that the growth of the last year has not begun, when the fish from the SE.- and S.-coast is concerned, at the end of April and March, respectively, whereas the other columns show that the growth is in full swing in the latter half of August.

The lower portion of the Table gives some informations about the growth and forming of rows of sclerites in young fish from different coasts; but as the material mostly is collected in the latter half of July and the first half of August, it gives no information about the beginning or the close of the growth in any of the localities recorded. Only a sample from Faxa Bay (Reykjavik) shows that a fish of the II-group has formed no winter-row at the very beginning of October, whilst some of the I- and 0-group have formed one on the 7th February. From this one might conclude, that the growth-period must, as far as fish from the S.- and SW.-coasts is concerned, last from abt. the beginning of May to mid-winter, with a stand-still in the early spring or, when the mature fish is concerned, in the spawning period. For giving any information as to other localities the material is quite insufficient.

When the figures in the upper portion are glanced at, one might have the impression that the number of rows of sclerites in the different year-zones were a true expression for the rate of the growth of the individual in question, and to a certain degree this is really the case (Fig. 1); but on a closer examination it will appear that both the number and the broadness of the rows of sclerites in every particular year-zone, as the size of the scale itself, is pretty independant of the locality and of the size and age of the fish in question.

3. Sexual difference in size and age. Maturity.

As in the case of the Codfishes previously treated I (and my assistant) have always when collecting scales from the Coalfish also examined the fish as to the sex and kept the sexes separated in the Tables above. Usually I have been able to determine the sex, except in the 0-group, or when the material, as sometimes has been the case with the I-group, was not quite fresh. — When the Tables III—X are glanced at a certain difference in the size of the sexes in each year-group is perceivable, but for an easier surveying of the matter I have put the figures indicating the mean length of the particular age-groups together, each sex separately, in the following Table, leaving the two youngest, and those elder than 11 years out of consideration as too scarce.

On the whole the material is too insufficient, as that from the N.- and E.-coasts only is represented by one of the youngest groups each and many of the groups from some of the sections, especially the IV-group and the V-group as well, are very defective. In spite of all this it will be seen, that there is a noticeable difference in the size of the sexes, the females being somewhat superior to the males. In many

Age-groups	II		III		IV		V		VI		VII		VIII		IX		X		XI	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
S.E.-coast	..	..	..	..	..	..	71.2	65.3	70.3	75.0	80.8	77.5	83.2	83.4	89.2	93.1	90.2	96.2	104.0	97.0
S.—S.W.[1])-coast	36.5	36.6	49.0	47.3	55.0	55.9	72.3	76.9	78.8	78.5	89.1	88.3	102.0	89.4	102.5	104.5[2]	104.0	105.0	..	..
N.W.-coast, IX	31.1	32.6	44.3	46.1	..	..	..	..	..	..	..	..	103.3	109.2	105.1	106.5	108.7	107.0	110.0	113.5
N.W.-coast, X	34.5	35.6	51.3	49.5	61.0	60.3	71.9	70.3	80.7	81.5	84.2	85.0	91.8	91.1	97.8	98.2	101.7	102.5	..	..
N.-coast	31.7	31.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
E.-coast	..	..	37.4	37.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

[1] Westman-Isles not included. [2] VIII—IX-group.

cases the reverse seems to be the case, the males sometimes being considerably larger, but this is surely due to the insufficient material (cfr. the particular Tables). In 13 cases of the 33 recorded in this survey, the females are larger than the males. At this stage of knowlege it is difficult to tell how great the difference is, but in most cases the difference in length is only 1—2 cm., which amounts to the females being until 2—3 % longer than the males. But closer inquiry into the matter is necessary for getting nearer to the truth.

As to the sexual maturity I have observed individuals of both sexes from the SE.-coast (Table VI) measuring 61—70 cm. in length, belonging to the V-group (i. e. just 5 years old) mature and partially spent, 66—73 cm. long males and 68—85 cm. long females of the VI-group and all elder fish mature and mostly spent. Of the fish from Hali (Table X) all three (40—55 cm.) and four (46—69 cm.) years old fish were immature, whereas of six years old fish males larger than 70 cm. and females over 80 cm. and all older fish were mature and spent. It is hardly necessary to say that all fish from inshore waters or elsewhere, four years old or younger, have proved to be immature. From this the conclusion must be drawn that the Icelandic Coalfish first grows mature (spawns for the first time), both sexes, when abt. 60 cm. long and just five years old (spawning season mid-February — end of April[1]), but the majority not before 6 years old (66—70 cm.[2]). How far there is any difference as to the staying of the fish at the different sections of the coast it is impossible to tell at present, nor how far the sexes reach maturity at the same age, which might be quite probable when the little difference in the size of them is taken into consideration.

4. The Weight of the Coalfish and the age.

When collecting material from Cod, Haddock and Whiting for age-determination I had always a good opportunity to weigh the fish, but not so with the Coalfish. In many cases I have had it indeed, especially when I worked on shore in the fishing places, but onboard the trawler neither my assistant nor I, myself could for various reasons practise the weighing. Because of this I must be contented with only giving some particulars about the weight of the fish in question from the NW.-coast, captured in the Isafjord Deep and on the nearest offshore grounds (cfr. Table III and IX), but unfortunately the material weighed must, as far as the elder fish is concerned, not be looked on as any typical one, and moreover is too defective in the case of three-seven-years old fish. Yet I think it will give an idea of the matter which is worth publishing, in lack of something better; the following Table will show the results. — In accordance with the wide range of variation in length of the individuals in the different age-groups the

[1] The extension of the spawning-season recorded here does not agree with the statement in the Synopsis of Fishes of Iceland, p. 27, that it should last "from mid-February to the equinox". This is due to the circumstance that the Author on his trip to the Selvog's Bank in the spring 1928, onboard the "Skallagrimur" found a lot of large Coalfish, which was ripe, but had not spawned the 19th of April.

[2] According to Damas, op. cit. p. 168, the Coalfish at Norway does first grow mature when abt. 45 cm. long and 3—4 years old.

weight of them is very variable, but not only the length, the condition of the fish with regard to fatness, development of the sexual organs, quantity of food in the stomach and so on, may exert a great influence as to give a very different weight to individuals of the same length.[1] Any further commentary is, in

Size and weight of Coalfish from the NW.-coast.

(cfr. Table III, A. p. 10 and Table IX, p. 17)

Age-years	Number of specimens	Variation of		Average	
		length cm.	weight g.	length cm.	weight g.
13—14	1	119	10800	..	..
11—12	5	104—118	8000—10500	111.0	9600
10—11	6	108—116	8000—10500	112.2	9600
10	9	101—114	6000—11500	108.3	8600
9	33	96—113	7000—11000	105.8	8600
8	25	94—117	5500—10500	106.2	8000
7	9	93—113	5000— 8000	101.1	6800
6	5	63— 98	3400— 8500	82.5	6700
5	1	63	1700	..	..
4	2	57— 60	1200— 1400	58.5	1300
3	6	45— 58	800— 1300	51.7	1100
2	17	27— 37	140— 480	30.4	300
1	19	16— 25	15— 150	20.9	125
0	43	6— 11	1— 8	8.1	3.4

my opinion, unnecessary, nor would any attempt to give the matter a graphical expression be justified on the basis of this defective material.

The considerable size of the Coalfish at Iceland causes the high weightiness of the fish. A long commercial practice has made good that the mean-weight of a grown-up Coalfish is 6.5 kg and 80 salted and cured (dried) fish amount to 180 kg (= 1 "skippund", the usual unit for weight of salted fish) whereas a grown-up Cod in average makes 5.6 kg or 130 fish 180 kg and the Haddock only 0.8 kg or 200 fish 180 kg.

5. The Age of the Coalfish and the Fisheries.

In my previous papers on the Age and Growth of the Icelandic species of *Gadus* I tried to sketch the relation between the age-groups of the species in question and the fisheries and give an idea of the possible influence of the use of the different kind of fishing implements upon the stock of the fish.

In its habits the Coalfish differs much from the Cod and the Haddock. In first instance it is, when the common life of the fry is finished, young and grown-up, much more pelagic in its manners than are the others and may often (the older ones) in the warmer season be observed in enormous shoals roaming about in the very surface of the sea, like as many diminutive whales, and giving it an appearance of boiling water. On the other side it dives down to the bottom in abt. 200 m. depth. In the same manner the young ones in inshore waters keep themselves in all depths between surface and bottom.

As to the capture of this fish it is carried out partly in shallow inshore waters partly in open sea. In the inshore waters the 3—4 first year-groups (0—III-group) are taken in drag-seines or herring-nets all round the country, when the conditions are prosperous, yet on a rather limited and variable scale, according to the statistics[2] some 500—3000 barrels yearly. Not seldom they are also accidentally caught

[1] Cfr. the author, Age and Growth of the Haddock etc. page 23.

[2] Fiskiskýrslur og hlunninda (Statistique de la pêche etc.) issued by the Statistical Bureau of Iceland.

in purse-seines during the herring-fishery. The usual size of this fish will be seen in the Tables I—V, especially in the Table II, e, IV (Hafnarfjord and Reykjavik) and V (Nordfjord), where the bulk of the fish is captured in the autumn and mid-winter (October—February). Bearing in mind how enormous is the number of these young fish, which often is to be seen staying close to the beaches, quite protected against the destructive influence of the Ottertrawl, especially on the SW.- and W.-coast, the comparatively small catches of this immature fish will give no cause to any anxiety as to the depleting of the stock.

While the youngest age-groups of the Coalfish keep staying in the nearest vicinity of the shores and are therefore only caught there, the elder ones are mostly living in open sea, the youngest (III—IV) groups from time to time paying short visits to their homes of youth, the mature fish very seldom or never appearing in shallow inshore waters. The fish of this kind is an object of an intense fishing by the natives and foreigners, all round the coast, on the S.-coast by trawlers and gillnet-fishers during the spawning period (February—April), on other coasts by trawlers and long-line-fishers, especially off the SE.-coast in May and off the NW.-coast in summer and autumn. The Tables VI—X are giving a fairly good idea of the composition of the catches made by trawlers and long-liners on offshore grounds.

In spite of the nearly 18 million kg of large Coalfish caught by foreigners and 34.7 million kg by the natives no signs are noticeable indicating any depletion of this fish, which is presumably one of the most numerous in the waters of Iceland.

II. The Norway Pout (Gadus Esmarki Nilsson).

Whereas the other species of the genus *Gadus*, treated by the present writer as to Age and Growth, are large fishes and directly more or less valuable as food-fishes, this bright little fish (Icelandic spærlingur) is of no direct economic importance, for which reason it will be intelligible that it was hardly known or noticed by the native fishermen before the beginning of the present century.[1] Nevertheless it has proved to be "perhaps the most numerous of all *Gadus*-species at Iceland"[2] and plays an important part as food for its larger relatives as the Cod and the Ling and for many other fishes. — While the other species treated by the author are to be met with all round the coast, this is in its distribution confined to the warmer water along the S.-coast, from Ingolfshöfdi and the W.-coast up to Djúpáll (Hali), where it lives mostly on the edges of the outer banks, feeding on small crustaceans (*Calanus, Rhoda, Meganyctiphanes*) and scopelids. After the spawning which coincides with that of the Cod, it moves on to the shallower grounds, but retires some time in autumn. The pelagic fry is to be found in very great numbers in the early summer-months off the S.- and W.-coasts where it has often been caught in thousands in one short haul by the little young-fish-trawl or towing-nets (Schmidt). But on the other side of the north corner of the NW.-peninsula (Cape North) they have never been found. When the real pelagic life is finished, the young fish seem to move on to deeper water and stay there until they as abt. two years old and mature fish seek the spawning grounds.

A. Age and Growth determinations.

a. Collection of material.

Although the Norway Pout is a very frequent fish in the warmer waters at Iceland, material for examination is hardly to be collected on the fishing-places ashore, as it is the object of no direct fishing. Certainly lots of the fish can be taken from the stomachs of the Ling in the spring at Westman Isles, but usually the fish is too much mutilated to be any good object for examining. A direct fishing of it for my purpose would have been too expensive. For that reason I chose once more the way of cooperating with

[1] Author, Synopsis of the Fishes of Iceland, page 27.

[2] Schmidt Johs., The Distribution of the pelagic Fry and the spawning Regions of the Gadoids etc. page 66, chart V.

the deep-sea-fishermen, this time the trawlfishers, as the fish in question, in spite of its smallness, gets intricated in the comparatively wide meshes of the trawl and is often taken in great numbers in the trawl when the trawlers are fishing in deep-water for Cod. I therefore as on many other occasions applied to the captain of the trawler "Skallagrimur". Mr. GUDMUNDUR JONSSON, who provided me with most of the material needed.

This material was collected as follows:

In March 1923 and 1924 421 specimens were taken on the Selvog's Bank by the "Skallagrimur" and preserved in salt.

In April 1924 114 specimens were taken in the locality onboard the same vessel and preserved in the same manner.

In October 1924 material from 59 specimens was collected onboard the same vessel on Hali (NW.-coast).

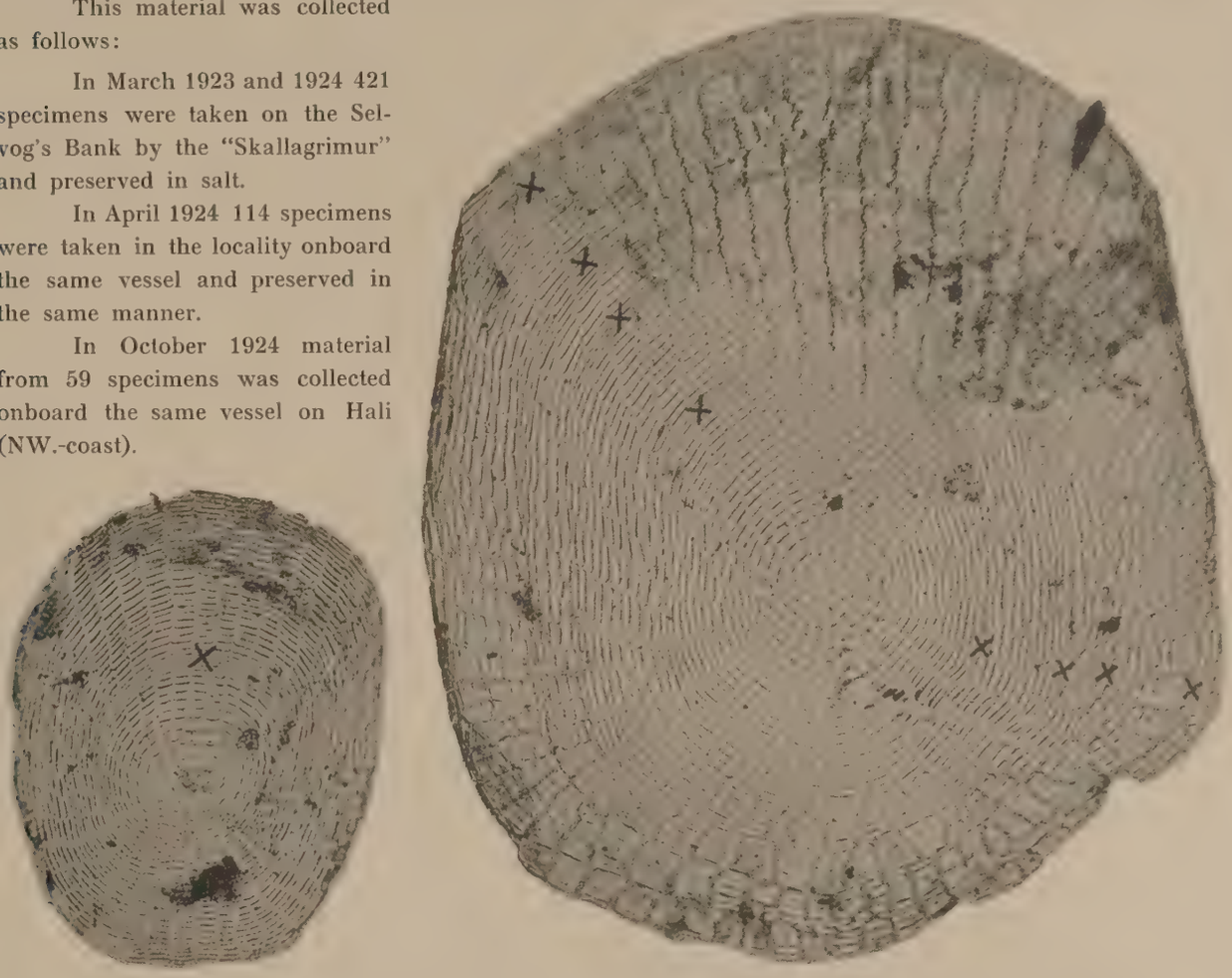

Fig. 4. Scales of *Gadus Esmarki*, Selvog's Bank c. 15-III-1923. A. II.-group 17 cm. ♂, B. V-group 23 cm. ♀.

In June 1924 material from 25 specimens was collected onboard the research-vessel "Dana" in the Faxa Bay by the author and in May 1925 he collected onboard the "Skallagrimur" material from 58 specimens caught on Selvog's Bank.

From the above given records it will be seen that I have got material for age-determination of the fish in question as follows:

from the SW.-coast	from	618	specimens
— - NW.-coast	—	59	—
Total	—	677	—

b. Methods of Age-determination.

For age-determination of the Norway Pout as for that of the other species of *Gadus* the otoliths, the scales and may be also different bones are good objects. The most convenient objects for reading the

age are, no doubt, the scales; small as they are, they are very delicate and quite transparent and easy to examine under the microscope, but unfortunately they are very deciduous and will be totally scratched off when the small fishes are exposed to the rough treatment, when buffeted about among far bigger and hardier fish in the trawl-bag; from only some 40 specimens, or abt. 6% of all the material collected I succeeded in getting some scales, usually from the least exposed or most protected spots, as from under the pectorals, and for that reason I only used the scales for checking the reading of the age on the main-object, the otoliths. Otherwise the general features of the scales, which have some resemblance to those of the whiting, will be seen from the following picture (Fig. 4). In one case I have found a number of small or dwarfed scales, spread among the normal ones and "blanc" scales are sometimes met with. For this reason the otoliths became the principal object for the age-determination.

The otoliths of the Norway Pout are comparatively rather large (9—10 mm. long) and thick, somewhat ovate, obtuse in front, pointed back and the upper edge considerably sharper than the lower one (Fig. 5, A). For the reading of the age the otoliths are not so good as the scales, as they are comparatively thick and opaque, but in a fresh state, or, if dry, soaked in water the growth-zones may, especially in the case of the younger (1—2 years old) fish afford a reliable reading, but when elder fish is concerned the otoliths must be broken over as to get a cross-section of it, but in most cases no smoothing or polishing of the surface of fracture is necessary, as the growth-rings or growth-zones usually will be clear enough without it, when examined in a faint reflected light by the aid of a weak (× 2—4) lens[1]. Yet in the case of the elder (3—4 years old) fish, which make out nearly the half of the total number, in some 20 cases the reading has not been certain. This uncertainty as to the reading of the age on the otoliths is also due to the circumstance that secundary or false "winter-rings" are very frequent and often 2—3 in one summer-zone.

Fig. 5. Otoliths. A *Gadus Esmarki*, B *Gadus poutassou* × 2. *f* = fore-end, *u* upper edge.

c. Treatment of the material.

As the distribution of the Norway Pout along the coasts of Iceland is restricted to the S.- and W.-coasts (the warmer water) and the bulk of the material has been taken on the S.-coast, I find from that point of view no reason for keeping that from each place of capture separate in the same way as I have done when dealing with the Cod, the Haddock and the Coalfish, but think it more adequate to treat the fish caught in the same season (month) separately, as the time of capture covers the greater part of the year (March—October) and the fish in question in one case just is at the end of its growth-period (completing one of its years of age), in an other in the middle of that period.

As when dealt with the other fishes the results of the age-determination will be displayed in Tables, although these owing to the very limited size and age of the fish will not be as bulky as else.

1. Fish captured in mid-March. The material from mid-March consists of otoliths (and some few scale-samples) from 421 mature fish captured on Selvog's Bank off the SW.-coast in the years 1923 and 1924. The particulars will be seen in the following Table I.

This table includes all fish captured in March; now as the spawning-period mainly is April and the fish is mostly caught in the middle of March the year-groups indicated have hardly completed the particular years they are referred to. Yet this will make no noteworthy difference as to the size attained by each individual when finishing the year concerned, as the growth at the close of the winter (or age-year) presumably is very slow or none. — The Table comprises fish of all sizes from 14 to 24 cm. (the greatest length recorded in this paper, while the size at Iceland[2] and elsewhere[3] does not surpass 25 cm.)

[1] Cfr. the Author: On the Age and Growth of the Cod etc. Medd. fra Komm. for Havundersøgelser. Serie Fiskeri. Bd. VII. Nr. 3, page 6.

[2] Author: Fiskarsiiro, page 256.

[3] Lillieborg, W. Sveriges och Norges Fiskar, II, page 99.

and only 18, or, roughly spoken, 4% of them are more than 20 cm. Save for one, which is five years old, all these fish belong to the age-groups II—IV and only 19 (or 4,5%) to the IV-group whereas the remainder (94%) belong to the groups II and III, the majority, or 270 to the last and only 132 to the first. It will be seen from the Table that the youngest group, the II-group ranges in size from 14 to 18 cm., mean length 16,5 cm. — The next or the III-group ranges from 16 to 21 cm.; average length 18,0 cm. and the average increase in length from last year 1,5 cm. — The IV-group ranges from 19 to 24 cm.; average

Table I. Norway Pout. SW.-coast. Selvog's Bank, mid-March 1923 and 1924.

Age-groups	II		III		IV		V	
Sex	♂	♀	♂	♀	♂	♀	♂	♀
Length cm.								
25	..	..	..	..	..	..	..	..
24	..	..	..	..	..	1	..	..
23	..	..	..	..	..	4	..	1
22	..	..	..	..	1	1	..	..
21	..	..	..	9	..	2	..	..
20	..	..	5	35	2	4	..	..
19	..	2	27	55	1	1	..	..
18	4	7	67	31	..	..	..	..
17	42	18	36	2	..	..	..	..
16	36	6	4	..	..	..	..	..
15	15	..	..	..	..	..	..	..
14	2	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..
Average length	16.3	17.2	17.9	19.0	20.2	22.2	..	23.0
	16.5		18.0		21.8			

length 21,8 cm. and annual increase 3,8, which is too high in proportion to the increase in length for the preceeding group. — The V-group is left out of consideration.

The particulars given above concerning the fish caught in Mid-March will be seen more clearly from the following summary.

Age-groups	II	III	IV
Variation in length	14—19	16—21	19—24
Average length	16.5	18.0	21.8
Average annual increase	..	1.5	3.8

2. Fish captured at the end of April. — The material collected at the end of April consists of otoliths (and some few scale-samples) of 172 mature specimens caught in trawl on Selvog's Bank April 20th—May 1st 1924. The particulars will be seen in the following Table II.

Like Table I this only deals with mature Fish, but this is captured later in the year, or at the close of the spawning period, at the very beginning of a new age-year. — As will be seen the Table only shows three year-groups, the II-, III- and IV-group of which, as in Table I, the groups II and III are predominant. The II-group ranges in length from 14 to 20 cm., mean length 16,3. — The III-group ranges from 18 to 22 cm., average length 19,4 and average annual increase 3,1 cm. — The IV-group ranges from 19 to 23 cm., has a mean length of 21,5 and an annual increase of 2,1 cm. — The following summary will give a clearer survey of the contents of the Table.

Table II. Norway Pout. SW.-coast. Selvog's Bank, April—May 1924.

Age-groups	II		III		IV	
Sex	♂	♀	♂	♀	♂	♀
Length cm.						
25	..	..	..	..	..	..
24	..	..	..	..	..	..
23	..	..	..	..	..	6
22	..	..	..	1	1	3
21	..	..	..	5	..	3
20	..	2	1	13	..	6
19	1	6	3	14	..	2
18	10	6	3	5	..	..
17	10	4	..	..	..	..
16	11	23	..	..	..	..
15	18	7	..	..	..	..
14	7	1	..	..	..	..
13	..	..	..	..	..	..
Average length	16.0	16.7	18.8	19.6	22.0	21.1
	16.3		19.4		21.5	

Age-groups	II	III	IV
Variation in length	14—20	18—22	19—23
Average length	16.3	19.4	21.5
Average annual increase	..	3.1	2.1

Table III. Norway Pout, SW.-coast, Faxa Bay, June 1924.

Age-groups	I			II			III	
Sex	♂	?	♀	♂	?	♀	♂	♀
Length cm.								
20	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..
18	..	..	..	1	2	4	..	1
17	..	..	..	3	..	2	..	..
16	..	..	..	..	..	1	..	..
15	..	..	..	..	..	..	..	..
14	..	..	1	..	..	..	..	..
13	4	1	2	..	..	..	..	..
12	3	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..
Average length	12.6	13.0	13.3	17.2	18.0	17.4		
	12.8			17.5			18.0	

3. Fish captured in June. — The material collected in June is rather poor, as it counts otoliths (and very few scale-samples) from only 25 specimens of fish, caught in trawl in the Faxa Bay, SW.-coast on the 19th of June 1924. The particulars are displayed in Table III.

Whilst the Tables I and II only deal with mature Fish, many of the specimens recorded in this Table are young immature fish, and save for one (of the III-group) all are belonging to the I- and II-groups. — The fishes of the I-group range in length from 12 to 14 cm., average length 12,8 cm. — The II-group ranges from 16 to 18 cm., mean length 17,5 cm. and average annual increase 4,7 cm. — The poor material treated in this Table hardly needs any further surveying.

4. Fish captured in October. — The material collected in October is also rather poor, only comprising otoliths (and some scales) from 59 specimens caught in trawl on the Hali, off the NW.-coast, October 14th, 1924.

Table IV. Norway Pout, NW.-coast, Hali, Mid-October 1924.

Age-groups	0	I	II	III
Sex	♂ & ♀	♂ & ♀	♂ & ♀	♂ & ♀
Length cm.				
20	..	..	6	2
19	..	..	4	..
18	..	2	1	..
17	..	5	..	..
16	..	14	..	..
15	..	16	..	..
14	..	9	..	..
13	..	..	..	..
12	..	..	..	..
11	..	..	..	..
10	..	..	..	..
9	1	..	..	..
Average length	9.0	15.5	19.5	20.0

The majority of the fish treated in this Table is young and immature fish, as only two belong to the III-group and 11 to the II-group. On the other side one specimen of the 0-group is noticeable. Owing, partly to the little developed reproductive organs, partly to the deficient preservation of the material, the sexes are not treated separately. The length of the single specimens of the 0-group is 9 cm.; those of the I-group range in length from 14 to 18 cm., mean length 15,5 cm. and the annual increase should be somewhere abt. 6 cm. — The II-group ranges from 18 to 20 cm. mean length 19,5 cm. and the average annual increase 4 cm. — The length of the two specimens of the III-group is 20 cm., and so the annual increase should be only, 0,5 cm. — Further surveying is unnecessary.

It must be borne in mind, when the size of the fish treated in this Table is to be compared to that of the fish treated in the other Tables, that they are captured at the close of the warmer period of the year, when the rapid summer-growth is ceasing, and that they are half a year older and in fact have attained a size nearly corresponding to one year of age more than indicated in the Table.

d. Summary. Age and Weight.

After having recorded the results of the Age-determinations of the Norway Pout, I shall now shortly review these results and summarize them in the following Table, where the mean lengths of the fishes treated above will be arranged according to the season of capture, whilst the locality this time is left out

of consideration as being of minor importance because of the limitation of the habitat of the fish to the warmer water.

When looking at this survey and remembering the contents of the Tables on the preceding pages, we shall as the most outstanding feature notice the low number of age-groups, these in fact only being five, which means that this fish does probably not reach any high age at all. Of all the nearly 700 specimens examined only one reaches the age of five years, and only 39 specimens, or abt. 6%, grow

Age-groups	0	I	II	III	IV	V
Mid-March	—	..	16,5	18.0	21.8	(23.0)
End of April	..	..	16.3	19.4	21.5	..
19th of June	..	12.9	17.5	(18.0)	..	..
Mid-October	9.0	15.5	19.5	20.0	..	..

four years old. Thus the age of the Norway Pout at Iceland usually proves to be four years, whereas five years old fish is very scarce and probably it does not reach any higher age at all. As to this it is much inferior to the larger Icelandic species of *Gadus*. — As will be seen in the Tables above, the majority of the four-yearlings is females.

For tracing out the rate of growth the material is evidently too poor, as far as the younger year-groups are concerned and moreover the scanty material representing these is taken in time different from the other material. — The material at my disposal was quite insufficient for determining the age by the method of scale-measurement, as only some few figures and no good means would have been provided. — As another method I might have used the grinding down or polishing of the otoliths for getting longitudinal sections on which the age might have been determined by measurement of the length of the single year-growths. But such method had to be based upon the fact that the length of the otoliths at every age was proportional to the length of the fish, which was first to be proved. For this reason I was compelled to use the old way of calculating the average length of the special year-groups. — As in the case of the Coalfish the length of the particular year-groups of the Norway Pout are to be referred to the end of April (the beginning of the single growth-periods). At that moment of time any 0-group does not practically exist. — As to the I-group it is to be pointed out that in the material treated only one 9 cm. long specimen of the 0-group, caught in mid-October is recorded, which size agrees fairly well with the fact that SCHMIDT has taken enormous number of pelagic fry off the S.- and W.-coast[1]; in June they are abt. 15 mm., in July 25 and in August abt. 50 mm., which sizes agree pretty well with that recorded from October. Supposed that the growth-period lasts to January, I should think the average length of this group, which at the end of next April has become the I-group itself, was abt. 11 cm. — For the determining of the mean length of the other year-groups the material must be regarded as quite sufficient. — Of the II-group I have examined 250 specimens, 226 of which were taken in March—April on Selvog's Bank. The mean length of these (those from June and October left out of consideration) is 16,4 cm., which figure smoothed to 16,5 cm. should express the average length of this group at the beginning of its third year. The mean size of the specimens of the I-group recorded as taken in June in Faxa Bay and in mid-October off the NW.-coast agree fairly well with this. — The III-group is the richest one, 319 specimens, all except three of the March—April catch. Its average length (without the three) is 18,7 cm., which figure, smoothed to 19,0 cm. would be the mean length of the group at the beginning of the fourth year. — Of the IV-group only 38 specimens, all caught in March—April have been examined. Their mean size is 21,7 cm., which figure smoothed to 21,5 cm. would be the average size of that group at the beginning

[1] The distribution of the pelagic fry and the spawning regions of the Gadoids etc., page 66.

of the (perhaps in most cases never completed) fifth year. — The V-group only represented by one single 23 cm. long specimen must be left out of consideration.

From the above recorded it will be seen that the age of the fish in question is very limited, being at the highest five, but usually only four years, when the fish (the great majority females) will die after having finished the (second?) spawning. It will therefore be quite intelligible that the rate of growth must be very different in the different years of the age, more different than is the case with the larger species of *Gadus*. The proportion expressed by the figures 11,0, 16,5, 19,0 and 21,5 makes clear (Graph, Fig. 6), that the fish having completed its first year (one fourth of its normal age) already has attained the half of its average length, when four years old. At the close of the second year the fish has got $^3/_4$ of its length and can be looked upon as grown-up, and partly mature (see beneath).

To the records given above of the age and the growth I can add some about the weight of the fish elder than one year, as I have weighed 383 specimens of the fish taken on Selvog's Bank 1924 and the results will be seen from the summary below, and in addition to this I will remark that the weight of the I-group at the same time must be something like that of the other species of GADUS when they are of the same size (abt. 11 cm.), or abt. 10 g.

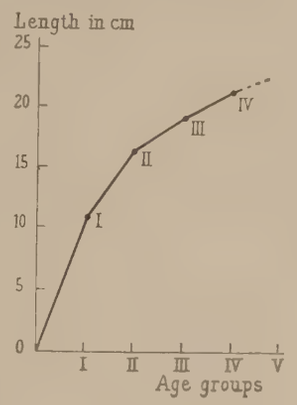

Fig. 6. Growth curve for Norway Pout, South-west coast of Iceland.

B. Seasonal changes in Growth.

I gave a short description of the scales of the Norway Pout above (page 28) and mentioned their resemblance to those of the Whiting. As in the case of this and the other *Gadus*-species treated by the Author, they are very good objects for studying the changes in the growth at different times of the year. Although the scale-material collected was very scanty, it proves to be sufficient, and very convenient for this purpose, having been collected through the greater part of the year (March—October) and the fish in its distribution along the coast is confined to the warmer waters only. Zones of rows of different sclerites interchange here as in the case of the other fish mentioned, broad summer-zones and narrow winter-zones in succession from the centre of growth, with usually well marked limits between winter- and summer-growth, more indistinct between summer- and winter-growth. I have examined some few scales from different seasons for this purpose and am giving the results for some of them in Table p. 34.

Weight of three year-groups of Norway Pout SW.-coast.

Age-groups	Number	Length, cm.	Weight, g.	Average	
				Length	Weight
IV.....	15	19—24	34—100	20.9	45
III.....	253	16—21	18—60	18.4	35
II.....	115	14—19	10—38	16.5	25

From the records given in this Table it will be seen, that the growth, to judge from the number of rows of sclerites, which on the whole are of a similar broadness at the same time of the year, is somewhat irregular, as the number, e. g. in the first year varies from 13 to 23 in the six examples recorded. It is also conspicuous that there is, on the whole, a great difference in the speed of growth summer and winter, the summer-growth (to judge from the number of rows of sclerites) being 2—6 times as quick as the winter-growth; yet in some few cases there is hardly any difference at all. It will be seen from the examples taken at different time, that the summer-growth does not, as far as the older fish is concerned, begin before the end of April (or of the spawning period), whereas it is in rapid progress in mid-June

(having already added 5—8 rows of sclerites to the precedent year's growth. From the single example from Hali it appears that the summer-growth is not finished and the winter-growth begun in mid-October. From the above said I must draw the conclusion that the months May—October may be regarded as the season

Locality	Date	Age-groups	Length cm.	Number of rows of sclerites[1]) in each year-zone
Selvog's Bank	$^{15}/_{3}$ 1924	V[2])	23	21 (16 + 5), 15 (12 + 3) 10 (5 + 5), 12 (10 + 2), 5 (4+1).
—	—	II[2])	17	23 (18 + 5), 16 (12 + 4).
—	$^{20}/_{4}$ 1924	IV	23	20 (17 + 3), 16 (9 + 7), 18 (13 + 5), 7 (5 + 2).
—	—	III	21	19 (13 + 6), 18 (12 + 6), 6 (5 + 1).
Faxa Bay	$^{19}/_{6}$ 1924	II	16	13 (11 + 2), 21 (17 + 4), 8.
—	—	I	13	18 (15 + 3), 5.
Hali	$^{14}/_{10}$ 1924	I	16	23 (16 + 7), 10.

[1] The two figures in brackets indicate the number of respectively summer- and winter-rows.
[2] The last year not wholly completed.

for rapid growth, whilst it gradually slows down through the wintermonths and comes to a standstill in the early spring (March—April).

C. Sexual difference in size.

It has been shortly mentioned above, that the spawning period of the Norway-Pout is the same as that of the Cod, viz. April and the first half of May and that the fish, generally spoken, grows mature when two years old. — As when dealing with its other relatives I have as far as possible determined the sex of all specimens examined (this has as a rule been easy enough, as I mostly have dealt with mature and ripe fish) and put them down separately in the Tables. The particulars concerning this matter shall be given in the following summary.

Age-groups	I		II		III		IV	
Sex	♂	♀	♂	♀	♂	♀	♂	♀
Selvog's Bank	..	..	16.3	17.5	17.9	19.0	20.2	22.2
—	..	..	16.0	16.7	18.8	19.6	22.0	21.1
Faxa Bay	12.6	13.3	17.2	17.4	..	..	..	..
Number	7	3	150	90	146	171	5	33

From this summary a marked difference in the size of the sexes is easily recognizable, the females being considerably larger than the males. With only one exception, which surely is due to insufficient material, in all age-groups (the V-group with its one specimen left out of consideration) the females are the larger ones. In the groups most largely represented (II—IV) the difference amounts to some 2—10 %, which percentage indicates the inferiority in size of the males compared to the females. The rule will hold good, also in the case of this *Gadus*-species, that the females are comparatively larger than the males and the difference may rise to 8—10 %.

When the numbers of the individuals of each sex in the particular age-groups are compared, it will be seen that the males are most numerous in the I- and II-group and very few in the IV-group, where and in the III-group the females are predominant, whilst the males are so in the lower groups (I—II-group). — Now it was stated above that the majority of the males already was mature when growing two years old, while that of the females first was so, when three years, and as nearly all the fish belonging to the II-group and upwards are mature, the figures will show an approximate proportion between the number of mature fish of each sex in the different year-groups. From this fact the conclusion must be drawn, that

the males of this fish, like those of the other Icelandic *Gadus*-species examined, are not only inferior to the females, as to the size, but do not on the whole reach as high age as they, and the difference must at an average be one year or so.

D. The Norway Pout and the Fisheries.

Although this fish, as mentioned in the beginning of this treatise, is of no direct commercial value, it does not succeed in escaping the most effective of the fishing implement, the ottertrawl, in which it often happens to be entangled in great numbers in spite of its smallness. When the trawlers are operating on localities where the fish is abundant — and of such there are many off the S.- and W.-coast of Iceland — they will take a couple of hundreds or even more in every of the 20—30 hauls made in the course of a day, which in the long run means an enormous number of destroyed fish on the hundreds of trawlers daily fishing off the S.- and W.-coast of Iceland, for very few will succeed in getting home again with a whole skin. Also onboard the Danish research-steamers great numbers have often been taken in the little trawl, e. g. off Ingolfshöfdi 1904 "Thor" St. 115, 48—75 m. depth, 556 specimens were taken in 28½ hour.[1] But in spite of this vast destruction and the enormous quantities, comparable with Sand-Eel, Capelan and Herring, which are devoured by different fishes, no signs of any depletion of the stock are hitherto perceptible.

III. The Poutassou (Gadus poutassou Risso).

1. Collection of material.

As recorded in the beginning of this paper, I have collected material for age-determination of a very limited number (32 specimens) of the fish in question out of a great number (several hundred) of the fish taken in the trawl onboard the "Skallagrimur" together with other common species of *Gadus* and other fish, in 180—200 m. depth in the Jökuldjup (NW.-Faxa-Bay). All these fish, which measured 18—35 cm., were immature and most of them with empty stomach, but in good condition. Beside this there were pretty many of them in stomachs of Cod.

Although the material is very poor, I think it sufficient for my purpose: to give an idea of the age of the fish as it appears at Iceland, where it can be looked upon as a juvenile (and perhaps a little irregular) visitor from more southern waters, which spends its youth off the warmer (S.- and SW.-) coasts of this country (at least in the warmer season), but retires to the open and warmer ocean when maturity sets in[2].

As far as I know no inquiry has hitherto been made into the age and growth of this fish, nor is this short treatise to be looked upon as anything more than a mere attempt at making out the age of the fish, when in our waters.

2. Methods of age-determination.

Regarding convenient objects for age-determination of this fish, like in other *Gadus*-species, different hard structures, as scales, otoliths and some bones might be used. As to the scales the specimens caught were, without exception, all stripped for all their scales, only a couple of loose scales adherent to a sample of otoliths, gave me an idea of what the scales of this fish look like; they agreed quite well with the description of them given by Lillieborg[3] and proved to be quite impossible for the purpose as distinct winter-rings are totally lacking. For that reason, as in the case of the Norway Pout, I took my refuge to the otoliths, which, at least the young ones, I had to deal with, proved to be a fairly good object for the age-determination.

The shape of the otoliths of the Poutassou will be seen from the picture, Fig. 5, B. Compared with those of the Norway Pout they are more elongated and slender, rounded fore and terminate behind

[1] Research-journal 1904.

[2] Cfr. the Author's Synopsis etc., page 28, and as to the spawning consult Schmidt, The Distribution of the pelagic fry etc., page 85 and Chart IV.

[3] Sveriges och Norges Fiskar. II, Upsala 1891, page 116.

in a rather sharp point. In many cases the age may be read by examining the semi-transparent hind-end of the otolith through a weak (× 2) lens, where the alternating pellucid winter-rings and the more opaque summer-zones may easily be distinguished. But in some cases the end of the first year's growth is indistinct and the breaking over of the otolith in the middle, or better still and often necessary is the polishing of the convex side of it, until it becomes sufficiently pellucid altogether for a clear recognizing of the first winter-ring, i. e. the limits of the otolith at the end of the first growth period, which has an aspect much like that of the Norway Pout or of the otolith of the Cod in general (cfr. the pictures A, Fig 2 and B. Fig. 7).

Fig. 7. Longitudinal sections of three years old Otoliths of *A, Gadus Esmarki, B, Gadus poutassou*×3. Somewhat simplified. The crenulated edges of the first year's growth are conspicuous.

3. Treatment of material; results.

The results of the age-determination of the few fishes in question will be seen from the following Table I, where the age of 31 fish is displayed, whilst that of one 25 cm. long male was not to be determined with certainty.

Only one specimen belongs to each of the groups I and II and two to the IV-group, whereas the great majority, or 27 specimens are of the III-group. Of this again the majority is females, which in size evidently surpass the males.

Otherwise the contents of this Table give cause for no extensive considerations. The bulk of the fish examined proves to belong to the III-group (is just three years old). But to this I can add, that both

Table I. Poutassou SW.-coast, Jökuldjúp, May 1927. Trawl.

Age-groups	I			II			III			IV		
Sex	♂	?	♀	♂	?	♀	♂	?	♀	♂	?	♀
Length cm												
35	..	..	..	..	..	..	..	..	..	..	?	..
34	..	..	..	..	..	..	..	..	..	..	?	..
33	..	..	..	..	..	..	..	..	..	..	?	..
32	..	..	..	..	..	..	..	..	..	..	?	..
31	..	..	..	..	..	..	..	..	..	..	?	..
30	..	..	..	..	..	..	..	..	..	..	1	..
29	..	..	..	..	..	..	..	..	..	..	1	..
28	..	..	..	..	..	..	..	..	2	..	..	..
27	..	..	..	..	..	..	..	..	4	..	..	..
26	..	..	..	..	..	..	4	1	4	..	..	..
25	..	..	..	..	?	..	3	..	4	..	..	..
24	..	..	..	1	?	..	3	..	1	..	..	..
23	..	..	..	..	?	..	1	..	..	..	..	..
22	..	..	..	..	?	..	..	..	..	..	..	..
21	..	..	..	..	?	..	..	..	..	..	..	..
20	..	..	..	..	?	..	..	..	..	..	..	..
19	..	..	..	..	?	..	..	..	..	..	..	..
18	..	1	..	..	?	..	..	..	..	..	..	..
17	..	?	..	..	?	..	..	..	..	..	..	..
16	..	?	..	..	..	..	..	..	..	..	..	..
15	..	?	..	..	..	..	..	..	..	..	..	..
14	..	?	..	..	..	..	..	..	..	..	..	..
13	..	?	..	..	..	..	..	..	..	..	..	..
12	..	?	..	..	..	..	..	..	..	..	..	..
11	..	?	..	..	..	..	..	..	..	..	..	..
10	..	?	..	..	..	..	..	..	..	..	..	..
Average length				24.0		24.9	26.0		26.1			
		18.0						25.6			29.5	

smaller and larger fish is known in Iclandic waters. On one side some few specimens 30—35 cm. long have been captured (Bowman, the Author) and these all probably belong to the IV-group as, together with the two recorded in the Table, the youngest of the group. — On the other side plenty of fish between 10 and 20 (and even 26) cm. long are often to be found in the stomach of Cod at the Westman-Isles in the spring. — The two specimens recorded in the Table, younger than three years, probably are of the largest specimens of the I- and II-group, to which the fish mentioned from the Westman-Isles must belong. — From the size of the particular year-growth in the otoliths of the specimens of the III-group the mean size of the two youngest (I- and II-) groups might be calculated; this I have not tried, but I have dared to fill up the gaps in the Table with signs of interrogation in stead of real figures, and think I am not far from right when I compute the mean size of the I-group to be abt. 16 cm. and that of the II-group abt. 21 cm. in the beginning of May, when the real mean-size of the III-group is abt. 25 cm.

Finally I can mention that Schmidt has taken pelagic fry, only 5—10 mm. long (the 0-group), in May—June[1] and more advanced youngs 5—8 cm. long in July—August[2] off the S.-coast of Iceland, so that five of the youngest year-groups — all immature fish — may be found there simultaneously.

The microphotographs in this and my precedent paper on the Age and Growth of the Haddock and the Whiting are taken by Mr. Chr. Cato under supervision of Mag. sci. Erik M. Poulsen, whereas the pictures of bones and otoliths are drawn by the Author.

[1] The Distribution of the fry etc. page 85.
[2] Ibidem, page 83, footnote.

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